Introductory Psychology For Students of Education

by

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PREFACE

In preparing the material for this book, the authors have not sought to write just another elementary text in psychology. Their purpose has been to arrange the material ordinarily included in an elementary text so as to make it useful primarily to students who expect to follow their introductory course in psychology with work in education or educational psychology. The authors believe that the present wide interest in child study and in adolescence, particularly in normal schools, teachers colleges, and schools of education, is highly desirable so far as our schools and the preparation of teachers are concerned. At the same time, the authors hold that the study of children and adolescents is the more significant the more it rests upon a knowledge of essential psychological materials and concepts. With this in view, the illustrations and applications selected were those relevant to the school and the educational process. Because of the basic purpose, no attempt has been made to give an exhaustive presentation of all of general psychology. The effort has been instead to select the essential material and to present it in such fashion as to point the student toward educational thinking.

The authors are jointly responsible, but the critical reader may like to know that one of them (Conklin) wrote chapters I, V, VI, VII, XI, XIII, XIV, and the other (Freeman) wrote chapters II, III, IV, VIII, IX, X, XII, XV, XVI, XVII, XVIII. This division was made by mutual agreement and with an effort to keep the same general plan throughout.

It is hoped readers will observe that a genetic point of view has been consistently maintained. The intention is to lead the student to think of the phenomena of general psychology as contributing to or hindering growth ... relative simplicity and ignorance of infancy to the ... ity and knowledge of maturity. References for fur...

have been selected both from this point of view and as aids to further pursuit of particular topics. No attempt has been made to supply exhaustive bibliographies on any subject. Rather, a few references have been selected for each topic which will assist the inquiring student, and perhaps also the teacher, to some of the best contemporary presentations of the subjects discussed.

We are indebted to Esther Worthington Freeman who, after reading a very large part of the first draft of the manuscript, offered many valuable suggestions, and who assisted with the proof and index; to Dr. William F. Bruce and Professor Paul J. Kruse, each of whom critically examined several chapters; to Dr. Ellis Freeman and Professor R. C. Davis who gave a critical reading to many of the chapters. Of course, they are not to be held responsible for the final product.

E. S. C.
F. S. F.

March, 1939.

CONTENTS

Introductory Psychology For Students of Education

Chapter II

ORIGINAL BEHAVIOR

"Instincts" as an Explanation of Original Behavior. It has been customary, until recently, for textbooks in psychology to offer lists, varying in length, of instincts as the materials of man's original nature. Now, for the time being, we may define an instinct as a complex adjustive form of behavior which may be employed without previous experience or learning. In a variety of fields, in fact, instincts have been invoked to explain practically every known form of behavior. One investigator[1] studied the use of the term, instinct, in many fields, including fiction, religion, philosophy, history, political science, magazines and newspapers, as well as in psychology, biology, and sociology. He found no less than 14,046 different forms of behavior called "instincts" by someone or other. Thus it seems the entire range of human behavior has been characterized, loosely, as instinctive; and it will be found that many of the alleged instincts are mutually contradictory forms of behavior.

There are several reasons why so much confusion exists regarding man's "instinctive" nature. In the first place, in non-technical writings and in the speech of laymen, the term "instinct" has been used, erroneously, as synonymous with "habit"; that is, simply to designate any activity that had become more or less automatic. In the second place, although in the technical field of psychology there is, of course, a more restricted use of the term, psychologists have not been in agreement with regard to its precise definition, nor with regard to the activities that should come under this category.

1 Bernard, L. L., *Instincts*, New York, Henry Holt, 1924.

Further, there is a tendency to call an activity "instinctive," as an easy way out, when its character and genesis are not readily apprehended. Similarly, when some forms of behavior are fairly common to or frequently observed in a given society, the tendency is to label them "instinctive" without giving due regard to the possibility that these might be merely specific and specialized expressions of a certain basic behavior potentiality, the *specific* local forms of expression being the result of the operation of common environmental forces. A case in point is the so-called "instinct of acquisitiveness" which some offer as an explanation of many men's desire, in certain societies, to accumulate material wealth far beyond their need or ability to consume. We shall have occasion to return to this matter in a later section of this chapter; but now, for the purpose of obtaining a background, let us inspect a few lists of instincts offered by some representative psychologists.

Some Listed Instincts. Although in their definitions of the term "instinct" psychologists are not in agreement as regards details, it will be found, nevertheless, that certain aspects of this form of behavior are emphasized by almost all. They stress that instincts are inborn or native, that they do not require previous education in their performance, that they serve to adjust the organism to his environment, that they are effective in producing certain ends often desirable, which the individual does not necessarily foresee, that they may undergo modification with age and experience, and that they are, basically, the springs of human activity.

The following instincts were given by William James, the American psychologist of the late nineteenth and early twentieth centuries: [2] sucking, biting (with chewing, grinding the teeth, grimacing, spitting out), clasping an object, carrying an object to the mouth, crying and smiling, turning the head aside, holding the head erect, sitting up, standing, locomotion and climbing, vocalization, imitation, emulation or

[2] *Principles of Psychology*, New York, Henry Holt, 1890, vol. 2, pp. 404-41.

rivalry, pugnacity, anger, resentment, sympathy, hunting, fear, appropriation or acquisitiveness, kleptomania, constructiveness, play, curiosity, sociability and shyness, secretiveness, cleanliness, modesty, shame, love, jealousy, and parental love.

The late psychologist, William McDougall,[3] enumerates twelve instincts, seven of which are said to be associated with well-defined emotions: namely, flight, repulsion, curiosity, pugnacity, self-abasement, self-assertion, and the parental; the other five, with less well-defined emotions, being reproduction, food-getting, gregariousness, acquisitiveness, and constructiveness.

A contemporary American psychologist especially noteworthy in educational psychology, E. L. Thorndike,[4] offers three major categories of instinctive activity: food-getting and protective responses, responses to behavior of other human beings, and minor bodily movements and cerebral connections. Under these headings he details a list of forty-two specific instinctive activities.

Numerous other lists could be given; and, as is the case with the foregoing, it would be found that all have a certain number of activities in common, but that they differ with respect to the extent to which certain activities shall be broken down and detailed, as well as in respect to the question of the innateness or learned character of a given behavior. The lists quoted above, and the others that could be quoted, do more than just demonstrate a difference of opinion among competent psychologists. They emphasize the difficulties of observing "original nature" and, in particular, of differentiating between what is inborn, or native, on the one hand, and what is learned, or acquired, on the other. These differences of opinion demonstrate also a predilection

[3] *Social Psychology*, London, Methuen, 1931 (22nd edition), chap. III. More recently McDougall has given up the term instinct and has described human propensities in terms of the processes and behaviors involved. See his *The Energies of Men*, New York, Scribner's, 1932.

[4] *Educational Psychology*, New York, Teachers College, Columbia University, 1913.

on the part of writers, formerly, to regard behavior as *either* inherited ~~or~~ acquired. That is to say, behavior, it was assumed, had to be either one or the other. We shall learn, however, that this conception of development and behavior is no longer held by a majority of either biologists or psychologists. Indeed, we shall see that the two factors—the inherited and the environmental—are parts of a single process of growth.

Difficulties of Observing Original Behavior. The first and obvious reason why it is difficult to observe man's original behavior—in the sense of the purely inherited, or innate—is his very long period of infancy, childhood, and adolescence during which ~~periods~~ his behavior forms grow, expand, diversify, become richer and more precise. From the moment of birth (and even during the pre-natal period, in fact, though to a lesser extent) the individual has been going through not only a process of physical maturation, but he has been subjected to a great multitude of experiences which affect his subsequent behavior.

Lower organic forms come into the world much better equipped, and in a relatively brief period arrive at adulthood. The development of their behavior, therefore, can be observed. And what is more, their environments frequently can be controlled experimentally, so that it is possible to isolate the effects on behavior produced by the presence or absence of certain experiences during the growth process. With the human organism such experimentation and control for a large portion of the growth period are obviously not possible. In fact, the only way we could completely isolate the effects of physiological maturation from those of experience, or exercise, would be literally to place the infant in a "psychological vacuum" and to restrain him from behaving in any way. For example, if we wished to study solely and purely the role of maturation in walking, we should have to restrain the infant from making kicking and stepping movements; we should have to restrain him from crawling and

creeping, and from standing. In short we should have to prevent the exercise of all preparatory activities which are antecedent to the particular behavior; in this case, walking. Only thus could we be sure of the purely instinctive character of walking.

Left to himself, the normal child is from infancy a dynamic organism, internally stimulated to constant activity; he is a seeker, who creates situations, as well as reacting to the stimuli that impinge upon him through his sense-modalities. All of these experiences and stimuli contribute to the growth and changes in his subsequent behavior.

Growth of Structures and Functions. In this respect, the individual's growth of behavior is not different from his other growth processes. In physical stature, ordinarily he does not attain his full growth until early maturity. And it is now recognized that in both height and weight, adult size is dependent in part upon environmental factors such as amount and quality of nutrition, disease history, exercise, and glandular functioning, as it is also dependent upon the individual's genetic constitution. The brain, it is recognized, continues to grow and to improve functionally until about the age of twenty. The sensory functions, as in vision, hearing, and sensitivity to pressure, are *relatively* well developed at birth and grow rapidly during the first three years of life; nevertheless, they continue a slow and gradual development until the late teens when they reach their functional maximum. The speed of motor response—as shown in rate of tapping or in time required to react to a stimulus such as a pin prick—represents sensori-motor [6] functions which increase in effectiveness as the individual grows older, until the age of perhaps twenty. The same is true of the precision and accuracy of motor control. Finally, those forms of behavior which we subsume under the name of "intelligence"

[6] Sensori-motor activities are those which follow directly upon sensory stimulation, such as an act which follows a visual or an auditory stimulus, etc. Such activity involves both afferent (ingoing) and the efferent (outgoing) portions of the nervous system.

continue to increase in capacity until the age of eighteen or twenty.

Nature and Nurture Are Not Separable. As already indicated, it is impossible—at least for the present—to state how much of any behavior, function, or structure is due to "natural maturation", and how much to exercise or nurture, that is, to environment. In fact, the attempt to place these two factors (variously called heredity and environment, or nature and nurture) in opposition to each other is unwarranted in psychology and biology. Biologically, what an individual inherits is not a structure or a function but, rather, the potentialities for developing certain structures and functions *under certain conditions during the period of development.*[a] Psychologically, the individual does not inherit specific behavior; but he does inherit certain behavioral and functional potentialities, the details and extent of whose development will be dependent in part upon the organism's environment during its period of growth. It is for this reason that some biologists and psychologists subscribe to the doctrine that every structure, function, and behavior is *both* inherited and acquired. This being the case, it is clear that the skills a child has, the attitudes he possesses, the knowledge he has gained, the interests he manifests, and his physique must be ascribed to his potentialities (genetic constitution) and to the conditions under which growth and functional maturation are taking place. Of the environmental forces the school and the home are two most significant agencies of education which furnish and control experiences of the child during the most rapid, and plastic, periods of growth: namely, infancy and childhood.

In this connection, H. S. Jennings, the biologist, has stated: [a]

What happens in any object—a piece of steel, a piece of ice, a machine, an organism—depends on the one hand upon the mate-

[a] Jennings, H. S., *Prometheus, or Biology and the Advancement of Man*, New York, E. P. Dutton (Today & Tomorrow Series), 1925.

rial of which it is composed; on the other hand upon the conditions in which it is found. Under the same conditions objects of different material behave diversely; under diverse conditions objects of the same material behave diversely. . . . Neither the material constitution alone, nor the conditions alone, will account for any event whatever; it is always the combination that has to be considered.

Organisms are like other objects in this respect; what they do or become depends both on what they are made of, and on the conditions surrounding them . . . always both [heredity and environment] have to be taken into account. (pp. 5-6)

In man, the number of diverse sets [of traits] that may . . . be produced is very great; although it is, of course, not unlimited. But what the limitations are cannot be stated from general biological principles or from what we know of any other organisms; they can be discovered only by concrete studies of man himself. (p. 55)

While it is true that Jennings speaks primarily as a biologist and bases his conclusions upon biological experiment, his statement is psychologically significant because there is similar psychological evidence and because in man's behavior the nervous system is fundamental. Although there is disagreement in regard to the essential detailed factors of neurological development, as it affects behavior, there is complete agreement on the general principle that the nervous system—including the brain—is significant in the onset and development of behavior.

The significance of the nervous system in behavior, even in earliest infancy, is shown, among others, in the nursing activities of normal children compared with those of congenital idiots, whose nervous systems are, of course, seriously defective.[7] In the case of the latter, little or no improvement in this behavior could be observed during infancy, whereas in the case of normal infants improvement began almost as soon as the behavior itself. This same point is emphasized by the remarkable instance of an infant, born without a

[7] Koffka, K., *The Growth of the Mind*, New York, Harcourt, Brace, 1928, pp. 87 f.

cerebrum, who lived for three and one-half years. This infant "took the breast at once, and sucked properly from the beginning." Yet it showed no improvement and soon had to be fed by a spoon. Sometime later, the infant was tried with a bottle, from which it was thereafter induced to take nourishment. Thus we see that a foundation for the act of sucking is laid in the lower—infracortical[8]—brain centers, though without co-operation of the cerebral cortex[9] it appears to be impossible to improve the act or to perfect its selective function. As was observed in the case of the idiots, they behave as though the act were each time new to them.

The Rôles of Maturation and Learning in Behavior. At this point, we might examine some experiments intended to throw light upon the questions under discussion in the preceding sections.

For this purpose, evidence derived from experiments with identical twins is most valuable, because so far as it is biologically and humanly possible, we have in identical twins two individuals whose genetic, or inherited, materials are alike. Any differences in behavior, therefore, at any time must be attributed to differences in experience, that is, environment, since their inherited potentialities do not differ. Gesell and Thompson,[10] using such twins, carried out an important experiment in motor development. At the age of 46 weeks, one of the twins, *T*, was given daily training in climbing a short flight of stairs, from the floor to the edge of a crib. This daily training continued for six weeks. But during this period of six weeks, the other twin, *C*, did not have any *specific training* in climbing. When the training of *T* was begun, she was passive and needed assistance at

[8] The mid and hind parts of the brain.

[9] This is the layer of gray neural substance which forms the outer coating of the cerebral hemispheres of the brain. These are the brain areas involved in learning, especially in the higher processes, as in speech, reading, recall, etc.

[10] Gesell, A., and Thompson, H., *Learning and Growth in Identical Infant Twins*, Genetic Psychology Monographs, vol. 6, no. 1, 1929. See also their *Infant Behavior*, New York, McGraw-Hill, 1934.

practically all of the treads. After four weeks of training, however, she climbed the stairs readily and without assistance. At the age of 52 weeks, the end of the practice period, she climbed the staircase in 26 seconds. On the other hand, twin *C*, who had not been having specific training, at the age of 53 weeks climbed the stairs in 45 seconds. Now *C* was given two weeks of training, and at the age of 55 weeks climbed the stairs in 10 seconds. Thus, the performance of *C*, after two weeks' practice, was distinctly superior to that of *T* after her practice period which lasted three times as long but came much earlier in her development. This difference the authors of the study attribute to the difference in age when training was given; that is, to greater maturity. At the age of 56 weeks, both *T* and *C* were of equal ability, as they were also at the age of 79 weeks.

From this study we may draw several inferences; it answers several questions, but leaves several others unanswered. In the first place, the study reveals that training and experience affect behavior; that is, differences in experience in the case of two individuals genetically alike will produce differences in behavior. In the second place, the experiment indicates that certain forms of behavior may be accelerated through systematic training, even though earlier training may be less economical than later. Third, the experiment shows that *at a given time*, behavior is not only a result of the process of maturation but is also in part the product of developmental conditions, demonstrating that earlier and intensive specific training will hasten and help to perfect a behavior-pattern which otherwise under diffuse and non-specific activity will grow slowly and less effectively. The three foregoing implications of the study are based upon the significant difference in time required by *T* and *C* to climb the stairs at the ages of 52 and 53 weeks, respectively; namely, 26 and 45 seconds.

On the other hand, it should be noted that specific training introduced at a later age was, in point of effort, more effective and that ultimately the results were as good as in

the case of earlier training. However, it would be a mistake to assume that the improvement of twin *C*, whose specific climbing experiences did not begin until the age of 53 weeks, was due merely to the greater "natural maturation" that comes with age. From the age of 46 to 52 weeks, while *T* was being specifically exercised, *C* was crawling, creeping, standing up, and otherwise exercising the structures and functions which later entered into climbing stairs. In other words, the untrained twin, *C*, was exercising itself in those less specific activities which are antecedent and necessary to the later specific behavior; in this instance, climbing. As indicated earlier in this chapter, the only way to discover the rôle of "natural maturation" (if there is such) would have been, in this study, to restrain twin *C* from exercising in any way the structures and functions necessary for climbing. That, obviously, would have been almost impossible and certainly undesirable.

This study, nevertheless, does emphasize the fact that behavior is a resultant of an individual's potentialities and environmental forces. The educational significance of the study, in addition to what has already been indicated, seems to be this, if we may generalize: there is probably an optimal time to begin various forms of learning, if the maximum of efficiency is desired; learning, though less efficient, can be begun earlier than might be customary, with the assurance of earlier effective behavior. We must add, however, that the particular ages will have to be determined experimentally for each activity, whether it be climbing, swimming, painting, writing, playing the piano, reading, or doing arithmetic. Furthermore, we may establish general or average ages or periods, but there will always be individual differences. And since the ultimate unit of education is the individual, teachers and others responsible for the educative process will have to be alert to deviations from the general, or so-called normal.

One or more of the foregoing conclusions are demonstrated in several other studies of the same problem. In one

of these,[11] language development was studied to determine the relative efficacy of early and deferred training in vocabulary. Again identical twins were used. One, *T*, was given daily training from the age of 84 weeks until the end of the 88th week. Then the training of the other twin, *C*, was begun at 89 weeks. The results showed that "the acquisition of language was strikingly alike for both twins, but in practically every phase twin *C* was slightly in advance of twin *T*." In this experiment the difference in learning, that is, in effectiveness, is due, apparently, to the difference in maturity during the learning period. At the same time the special training provided for these twins produced results which were significantly superior to expected results if "nature" had been allowed to "take its course."

The same twins, beginning at the age of 54 months, were subjected to further experiments, one receiving specific training in a particular behavior while the other was trained in the same activities, in the same way, several months later.[12] The performances were cutting with scissors, ring toss, walking boards (2, 4, and 6 cm. wide), memory for digits and memory for objects. With the exceptions of the 6 cm. walking board and the scissors test, the twin receiving the later practice showed the greater gain. The two exceptions, noted above, are probably due to the fact that the earlier ages were more nearly optimal; just as in the cases of the remaining tests the later ages were more nearly optimal for the kind of learning required.

Subsequently, these twins were retested in the performances listed above; and since specific training had been discontinued, it was found, quite naturally, that these had dropped to lower levels, and that both twins were then at the same levels in spite of their original differences under practice at different ages.

[11] Strayer, L. C., *Language and Growth*. Genetic Psychology Monographs vol. 8, no. 5, 1930.

[12] Gesell, A., and Thompson, H., *Infant Behavior*, pp. 316-17.

It is unfortunate, in these studies, that one of the twins was not denied formal specific training in some of the activities. If that had been done, then comparative testing after a significant period of delay would have yielded stronger evidence with regard to the durability of the effects produced by maturation and specific learning working together, compared with maturation working only with incidental practice. In any event, the studies cited reveal the relative effectiveness of integrating maturation and learning at different ages; they reveal that under conditions of training, levels of performance can be advanced very early in life; and that, as Gesell has said, "The end products [of maturation and learning] are blended beyond dissection."

The author of another study of the behavior of twins, differently trained, has arrived at several conclusions of significance to us in connection with the question of the relative rôles in performance,[18] of physiological maturation and learning. It was found, first, that the optimum effect upon a particular behavior-pattern was produced if the external influence was operative at the time when that particular behavior was at its earliest beginning stages, its inception. Second,

the permanence of the effect of repetition or restriction of an activity is dependent not only upon the time the experimental factor is produced but also upon the duration of its influence. As long as an organism or a behavior-pattern continues growing, so long does it have powers of restoration. Unless the period of deprivation has extended unduly, the restorative powers of the young child are enormous; hence the performances of a child whose activities have been restricted can at a later date, under the proper conditions, be brought to approximate the activities of the child whose opportunities for action have been stimulated. Since, however, the performances given the longest period of restriction were in the case of Jimmy [the untrained twin] the ones which were the most difficult to re-establish, there is reason to believe that if the period of deprivation had been continued sufficiently long powers of restoration as well as the performance per

[18] McGraw, M. B., *Growth: A Study of Johnny and Jimmy*, New York, Appleton-Century, 1935, pp. 259-60.

se would have suffered impairment. In the development of those behavior patterns where the gap between the inception of Johnny's practice period and the inception of Jimmy's exercise in the same activity was wide there occurred differences in the developmental phases of the pattern to a degree which was not apparent in the development of patterns wherein the boys had attained more comparable performance levels at the time the practice was initiated.

The activities in which differential training was given the twins included, among others, the following: locomotion, reaching and grasping, swimming, walking up and down inclines, skating, manipulation of stools and graded boxes to obtain an object out of reach.

Here again we have clear evidence of the integration of nature and nurture in the production of a form and level of behavior. The foregoing quotation indicates, also, that there are optimal times to be utilized in training, although training and experience can be effective during the entire period of maturation; that is, so long as the individual is in the formative or plastic stages. Practically, these and the earlier conclusions signify that during the entire period of growth children must be observed for the appearance of evidences of new behavior and interests, which may then be most effectively utilized and directed. This means that the various functions and forms of behavior grow at different rates, reaching their optimal levels for training and their maximum levels of development at different times. Finally, these studies indicate it is essential that the environment should provide stimulating situations and materials which will give incipient behavior and interests an opportunity to develop adequately. There is nothing in the studies cited above to indicate that behavior—whether motor or "instinctive"—is a mere process of unfolding; nothing to show that "behavior will out" regardless of the richness or paucity of environmental stimulation. In fact, it is justifiable to conclude that the quality, precision, and general skill of children's behavior could be enhanced and accelerated by means

of suitable early environment. There is also evidence to support this contention in respect to the higher, more complex behavior which we call "intelligence."[14] That being the case, the educational significance of the home in the earliest years and of the well-conceived nursery school and kindergarten becomes apparent, for as psychological growth may be facilitated with consequent improvement and refinement of activities, so it may be retarded by unfavorable environmental conditions, with consequent impairment of behavior.

Maturation and Learning in "Instinctive Behavior." In the early part of this chapter, it was stated that until recently the tendency was to explain human behavior as the manifestations of instincts; that is, native propensities which merely unfolded in the course of the individual's period of growth, the ways of carrying out the activities having been inherited. Several lists of instincts from the writings of several psychologists were given to illustrate the range of activities included under that category as well as existing differences of opinion.

It appears to us that a most important source of the confusion which surrounded instincts arises from a failure to give due weight to the interaction of *general behavior potentialities* and environmental forces; and as a result of this failure, a variety of behavior forms in children and adults have been called independent instincts, whereas they are very probably the end-results, the specialized and specific expressions of certain general behavior potentialities which have been subjected to environmental forces of a particular kind. For example, it is certainly true that "to eat" is common to all mankind from the day of birth; and we might, therefore, speak of a "feeding instinct." Yet, in different societies we find widely different, even contrasting, eating habits with

[14] Wellman, B. L., "Growth in Intelligence under Differing School Environments," *Journal of Experimental Education*, vol. 3, 1934, pp. 59-83. "The Effect of Pre-School Attendance upon the IQ," *Ibid.*, vol. 1, 1932, pp. 48-69.

respect to the implements used, the food eaten, and the rites attending meals or festivals. These differences are purely cultural; that is, environmental, in the broadest sense. However, superficial observation of the *details* of eating might lead the observer to assume an "instinct to eat meat" in one instance; in another, an "instinct to eat fish"; and in a third, perhaps, an "instinct of vegetarianism." In fact this is not unlike what has actually happened when many specific forms of behavior were cataloged as instinctive.

Differences in "Instinctive Behavior" in Different Societies. To illustrate the fact that in different societies we find decidedly different expressions of the same "instinctive behavior," or that some of the "instincts" are absent entirely, we turn to reports of anthropologists who have observed the cultures—that is, ways of living—of numerous primitive but contemporary groups.[16] These groups are all members of the human species. There is no reason to assume that basically they are biologically different from the rest of mankind. Therefore, we must conclude that the manifested differences in their behavior—as among themselves and contrasted with other nations—are due to environmental forces.

One of the most important and often mentioned behaviors is the "maternal instinct," which presumably is the reason why the mother shows so much care and interest in and gives so much protection to her offspring. Yet anthropologists report so many varieties of maternal behavior and attitudes that it is impossible to ascribe this activity to an inherited form. In some of the primitive societies, adoption is a common practice, the adoption sometimes being made before the child is born. In others, a child belongs to the man who pays the midwife. In some instances where adoption is a common practice, the foster parent-child relationship is felt to be as binding as blood kinship; whereas in other instances where adoption is practiced, the foster relationship is emphasized, and at times in a manner not too complimentary to

[16] See Klineberg, O., *Race Differences*, New York, Harper, 1935.

the child. Some primitive societies never use corporal punishment with children; and those individuals who do, they condemn as unworthy of having children. In certain groups, children are sold, whereas in others, children are welcomed and kept as practical economic assets; while in still others, infanticide is practiced. As Klineberg properly points out: "Unfortunately it is not always possible to discover the attitudes of the parents in these cases, and it may be that they are not always so indifferent to the loss of their children as these examples would suggest. At any rate it is clear that parental *behavior* [italics ours] is shaped by the particular forces—economic, social, traditional—operative in any community." [16] However, it is at least probable that if any of these various attitudes towards children violated a fundamental and insistent inherent form of behavior, they would not long persist in any society.

If the foregoing view with regard to cultural forces, as they shape parental attitudes, is valid, then the particulars of parental behavior in our own society must be ascribed to numerous social forces, such as public opinion, the attitude of church and state, and laws enacted to enforce prevailing views respecting the birth and survival of children. There are probably physiological conditions in the mother which are operative and which affect her early attitude toward the infant. But, "Over and above these . . . there exist the strong cultural forces which shape the behavior into socially prescribed forms." [17]

Aggressiveness is another "instinctive behavior" included in many lists and, therefore, often regarded as a universal characteristic of mankind. If this form of behavior is to be regarded as "instinctive," it must be not only universal but also rather uniform, within narrow limits, in its mode of expression. However, as in the case of parental behavior, we find, first, that where aggressive behavior does exist, its mani-

[16] *Op. cit.*, pp. 260-61. Reprinted by permission of Harper and Brothers.
[17] Klineberg, *op. cit.*, p. 262.

festations are so diverse that they must be regarded as the products of cultural forces; and we find, second, that in some societies aggressiveness is unknown. The Cree Indians are a non-aggressive, non-competitive group. They have, instead, attitudes of sharing and co-operation. Among the Hopi Indians, the "competitive spirit" and aggressive rivalries are absent. Where, in other societies, there are conflicts leading to aggressive behavior, the manner of settling the disputes varies markedly: from ferocious battle to the singing of satirical and abusive songs about one's opponent, or to the destruction of one's *own* property as a sign of one's superiority. Furthermore, the cause of aggressive behavior is not a simple entity or force which, for some mysterious reason, drives the individual or the group to conflict; but the cause is to be found in a number of factors, such as material interests, possession of women, superstitions, and a desire for approval or commendation of the group, in which, by tradition, success in conflict—not necessarily killing—brings social recognition and reward. Thus, differences in cultures make a given kind of behavior "natural" and accepted in one society and unknown or abhorrent to or ridiculous in others.

Similarly, acquisitiveness which often has been regarded as a compelling, universal, and immutable human trait, is shown to be as varied and as much the product of cultural forces as paternal behavior and aggressive behavior. Practices vary from complete common ownership, to a comparative disregard for property, to extreme emphasis upon individual ownership. Rivers, who studied primitive societies extensively, states that ". . . acquisition in the interest of the individual can be so greatly modified in response to gregarious needs that it practically disappears or only appears under special circumstances." [18]

With respect also to other activities, similar evidence is

[18] Rivers, W. H. R., "The Instinct of Acquisition," in *Instinct and the Unconscious*, Cambridge, 1920, p. 272. Quoted from Klineberg, *op. cit.*, p. 270.

available, demonstrating the importance of cultural influences upon the manner in which "instinctive" forms of behavior are manifested, or upon their very presence or absence. In the case of sex behavior, the practices, the concepts of right and wrong, differ from our own, but they are enforced with about the same severity. For example, jealousy—often given as an "instinct"—is frequently found to be lacking in some tribes. Self-preservation itself, which often has been regarded as a fundamental innate form of behavior, has been shown to be subject to cultural forces. For in some societies—as in Japan—suicide has become institutionalized. Also, in some primitive groups, suicide is practiced on a wider scale and for—to us—quite trivial reasons. Then, too, we may even question the value attached to sheer self-preservation by the peoples of many countries who have been and apparently still are ready to participate in self-destructive wars.

Thus it appears that even in those forms of activity which many persons in our society regard as basic and innate, environmental forces—that is, the cultures—can produce profound differences, resulting often in kinds of behavior which are directly antithetical as between different groups. Under these circumstances, then, manifested behavior cannot be regarded as merely instinctive.

The Nature of Original Behavior. The principle to be emphasized in connection with "instinctive" behavior is the same as the one demonstrated by the experiments in maturation and learning cited earlier in this chapter. The human organism is born with potentialities for a great variety of behavior forms: motor, intellectual, social, sexual, individual. In some of these more than in others, environmental influences affect the rate, quality, precision, and details of development; but in all of them, environmental influences are significant. Also, in some activities, more than in others, environmental factors are more apparent and easier to control for purposes of study. It has been indicated that in the

act of walking, antecedent behavior, or exercise, is essential, as are, of course, the actual attempts to walk. The same principle holds for swimming, climbing, manual skills, athletic skills, talking, reading, and complex mental processes. In each of those—in fact in all behavior—physical maturation is likewise essential.

In the case of "instinctive" behavior, however, the rôle of environment is obscured unless we study societies having cultures different from our own and different from one another. Then it becomes clear that many of the specific traits which give individuals and societies their character must be ascribed to the cultures in which human behavior potentialities develop. Thus, whether a people or an individual is altruistic or selfish, aggressive or peaceable, monogamous or polygamous, individualistically acquisitive or in various degrees collectivistic, etc., will depend upon the character of the society in which human nature has been formed. And the nature of changes in human conduct in a society will depend upon the intelligence and insight of its members to perceive the significance of their conduct in the total situation. Thus, human nature, in the sense of human conduct, can and does change. Educationally and sociologically, this principle is of basic importance; for it means that the kinds of individuals in any society, and therefore the kind of society itself, will be determined to a significant degree by the traits being fostered in the home, the school, and other social institutions.

This view of original human nature does not mean that at birth the individual is a "blank," having no fundamental innate behavior potentialities. It does not ascribe to the environment and experience sole influence in the growth of behavior and individuality. For in studies of infant behavior it has been observed that each activity follows a given sequence, although that sequence may be accelerated or retarded and details modified by the presence or absence of opportunities for learning. This fact indicates an innate

aspect of the growth process. Also, it has been found that training in certain activities proves ineffective if given too early; just as it proves partially or completely ineffective if given too late.[19] Again, this indicates that the proper degree of physical maturation is essential for learning under optimal conditions. Further, we shall see that there are activities which, quite clearly, are basic in character, having their beginnings in what we have called innate "behavior potentialities." Some of these activities, like feeding, are more readily observed than others, for they satisfy insistent and obvious organic needs. Others, like the desire for approval and curiosity are not so obvious; yet there is very good evidence for including them in the category of original behavior. The development of both of these types of activities will be elaborated in the next chapter.

"Behavior Potentiality" to Replace "Instinct." In place of the term "instinct," or "instinctive behavior," we have chosen to use the term "behavior potentiality" for several reasons. It gets away from the confusion and variety of connotations that attach to the first two. It does not signify a behavior that is predetermined in the character of its expression. Instead, it signifies *latent possibilities* of behavior which may find expression at the proper time, depending upon the individual's stage of maturation and upon environmental factors. It signifies that though *basic* behavior is the same in different societies or situations, particular manifestations may vary considerably. Thus, if we grant that the desire for approval is a basic human trait, we find it may express itself in the form of display of physical or intellectual powers; or in one's manner of dress; or in conformity or in disobedience, as in the school. Finally, the existence of behavior potentialities is not interpreted as the expression of mysterious and independent powers or entities. We regard the behavior potentialities as the product of specialized bodily organs, such as eyes, ears, hands, feet, ductless glands,

[19] See Gesell and Thompson, *op. cit.*; also McGraw, *op. cit.*

digestive system, and others, functioning together with a highly developed and specialized nervous system. This nervous system, including the cortical areas of the brain, enables the human organism to perceive more or less intelligently the objects and situations of its environment with which its bodily structures bring it into contact. It is no doubt true, of course, that in some behavior potentialities, as in hunger and sexual behavior, the specialized organic structures and functions create such intra-organic tensions and stimulations to behavior that intelligent control and insight are not always highly effective or even possible. But it is also true that these forms of behavior, as well as others, can be "educated", so that an individual's activities conform for the most part with the customs and practices of his society.

As the human organism matures morphologically and physiologically, his specialized organs, nervous system, and brain (as a part of the latter) develop, differentiate, and specialize functionally. The individual, through his organs and nervous system, is constantly stimulated by and acts upon his environment. There are things to see, to hear, to feel, to taste and smell. When locomotion becomes possible, there are places and things to explore; the individual's range of activity is expanded. As he gains greater and greater body control, as in the case of the hands and then the fingers, the extent of and interest in manipulation are increased, and the quality of behavior is improved.[20] The developing human organism *seeks* in his environment the kinds of stimulation and situations which will nurture his expanding and multiplying activities. Thus the extent to which an individual's behavior potentialities will develop and their particular expressions depend upon the character—that is, the details and richness or poorness—of the environment.

We may illustrate this last point by using an extreme case

[20] See, for example, Gesell, A., *Infancy and Human Growth*, New York, Macmillan, 1928; also Shirley, M. M., *The First Two Years*, 2 vols., Minneapolis, University of Minnesota Press, 1931 and 1933.

as an example, namely, that of children blind from birth. It has often been noted that such children are retarded in motor and intellectual development because, first, without the aid of vision they are seriously handicapped in learning to walk, if not entirely discouraged from doing so, and, second, without vision they are cut off from numerous situations which would nourish and direct their potentialities. When such children are taken in hand early enough by expert teachers who teach them to utilize their resources, striking changes in alertness, in general behavioral development, occur.

Now, a child need not be blind to suffer, though to a smaller degree, of course, in much the same manner as a blind child, so far as concerns the stimulation, development, and enrichment of behavior. Even though the organs themselves are intact, if there is little or nothing to see, to hear, or to manipulate, behavioral growth will be retarded or frustrated; the child's "curiosity" has nothing to work on. As another illustration, if the child does not come into contact with others, if he has no opportunity for group participation, his potential social behavior may fail to find expression, or it may develop very inadequately if the opportunity comes after the optimal period. Thus development of behavior may be adversely affected in various degrees, at least as much by defective environment as by defective organic development. The specific degree of influence by either nature or nurture is in general undetermined, but varies with the specific situation. Thus in one instance heredity might be the more important; in another, environment; and in still another both may be of equal importance. But in any event, the two always work together as integrals of a single process of development.

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Chapter III

ORIGINAL BEHAVIOR AND MOTIVATION

What are the kinds of original behavior that are found in man? We shall be concerned in this chapter, not only with giving an inventory and brief descriptions, but we shall point out that these original forms of behavior are the motivating factors in human activity. Behavior in any person or in any animal, from the human genius to amoeba, takes place for a reason; there must be a cause. It is the problem of the psychology *of motivation to attempt to disclose the causes; and* the study of this problem leads inevitably to the question of original behavior potentialities, for to these latter we trace the motivation of human conduct.

Motives—A Definition and Explanation. A motive is any basic determinant of behavior which initiates and sustains activity. That is to say, the original, or basic, needs of the organism are the starting points. The degree and manner of satisfaction are determined largely by socially governed practices which may and do vary from group to group.

By *"basic determinant" we mean an original need or want* arising *within* the organism and stimulating it to activity. As a result of this need which produces a state of psychological tension, the organism persists in its activity until the stimulating condition is satisfied and the state of tension is removed. This is true not only of behavior in childhood and infancy, but as well in adolescence and adulthood, even though, as the individual develops, especially during the two latter periods, the *forms* of satisfying his basic needs become stereotyped through experience, the direction and specific

character of which are determined largely by environmental factors.

To be motivated means to be spurred on to activity and to experience more or less emotion in the process. In referring to this, psychologists and others have used the terms drives, impulses, urges, tendencies, and the like; but regardless of the term used, the fundamental idea is the same. That is, they are dealing with the springs of action, the genesis of behavior. This is not a mere academic problem; for the basic determinants are the dynamic factors which—as already stated—initiate and sustain behavior, thereby furnishing the starting points and the fundamental reasons for the acquisition of information, the development of skills, the formation of attitudes, the development of habits of conduct.

Motives, in their expression, may be very simple and direct, as in the case of the infant that moves about uneasily and cries when hungry. But when it has been fed, with the consequent restoration of physiological and psychological equilibrium, the infant subsides. On the other hand, hunger might give rise to a complex series of events having social as well as physiological and psychological consequences for the individual. To satisfy hunger, and other bodily needs, a person will work, often at disagreeable tasks; or, under necessity, he may steal; or there may be employer-employee conflicts; or a whole class of people may precipitate a political transformation; or nations may even go to war. Of course, factors other than hunger often are involved in these more complex and socially significant forms of behavior; for other basic determinants are operative, as well as hunger. Often, also, when a form of behavior, originally due to a basic need, gets well under way, it becomes *self-sustaining* and *self-sufficient*. This last characteristic—being self-sustaining—is illustrated by the following: when children or adults eat and drink beyond the limits necessary for the satisfaction of hunger or thirst; or when a child originally attracted to an object by its newness or strangeness, explores it, then amplifies and

varies his behavior with the object apparently for the sheer satisfaction derived from the activity; or when a child, in a later stage of its development, learning new sounds and words repeats them time and again, it seems, for the sheer satisfaction derived from doing so. Or, also, when a person who has had to be frugal and thrifty but is no longer under such need, yet continues his frugality, but is now called "miserly."

The principle illustrated by the foregoing simple examples of self-sustaining and self-sufficient activity is important educationally. The principle indicates that interest can be generated in the subject-matter of study if, to begin with, the activity is properly initiated with respect to the learner's needs and if directed toward an end which the learner himself is able to appreciate or apprehend.[1]

The problem of whether persons do or learn something "for its own sake" is complicated by the fact that many activities are interwoven with numerous social implications involving, chiefly, a desire for recognition and for approval of a certain group of which one is already or wishes to become a member. In other words, some activities starting as behavior in satisfaction of one basic need become a means of satisfying another need. For example, the scholar's or scientist's interest in his subject very probably had its origin in the behavior potentiality called "curiosity." His specialty in time assumes for him a relative independence of existence: the origins of his interest in and devotion to the specialty may be obscured or lost; and he may say he likes the subject for its own sake. This is no doubt true to a degree. But he also finds in it his means of a livelihood; he uses it to advance his position among his colleagues and in professional societies, thereby satisfying his desire for recognition and

[1] Theoretically this is a sound and widely accepted principle among child psychologists. The "pure" scientist is satisfied to leave the matter here. But much the harder task falls to the "applied" scientist who tries to put the principle into practice in an actual situation in the school or the home.

approbation. Thus his achievements bring him satisfactions of basic needs of several sorts. Someone has said that everyone works with an audience in view, even if the audience be only the archangels. It is important to bear this in mind and recognize the great difficulty, if not futility, of trying at first to motivate a child by insisting on some forms of activity for their own sakes; or by presenting remote ends which he cannot apprehend.

Finally, as a characteristic of motivation, we must recognize that some of the basic determinants of behavior are clearly dependent upon biological needs. As such, their bodily bases, or correlates, are obvious, involving nerves, muscles, and glands. In this class of motives belong hunger, thirst, rest, elimination, and sex activity. There is, however, another class of motives whose physiological bases are not obvious. To this class belong curiosity, the desire for recognition and approbation, and social behavior. Yet, although specific organic bases for these behavior forms have not been demonstrated, we must assume that there are such bases, however complex; for without an organic basis behavior is inconceivable. Glandular disturbances, brain injuries, damage to the nervous system, and toxic conditions have been shown to affect profoundly behavior and personality.[2] Bodily states vary with different degrees of emotional expression and with quiescence, which are aspects of behavior potentialities. It is reasonable, therefore, to conclude that if a disturbance of the integrity of the organic system results in abnormal behavior, then a normally integrated organic system is essential to normal behavior.[3]

[2] See the discussion of the endocrine glands in the chapter on Personality.

[3] See, for example, Cannon, W. B., *Bodily Changes in Pain, Hunger, Fear, and Rage*, New York, Appleton, 1929; Bard, P., "The Neuro-humoral Basis of Emotional Reactions," and Landis, C., "The Expressions of Emotion," chaps. 6 and 7, respectively, in *A Handbook of General Experimental Psychology* (C. Murchison, editor), Worcester, Mass., 1934; Stockard, C. R., *The Physical Basis of Personality*, New York, Norton, 1931. See especially Freeman, Ellis, *Social Psychology*, New York, Holt, 1936, pp. 141-150, for discussion of bodily disequilibrium as a motivating factor in behavior.

The Reason for Behavior. It is clear that the study of motivation attempts to answer the question of why people behave as they do. Each question of "why?" may be answered in terms of the *immediate* and *obvious* objectives of behavior. For each such answer given, however, still another question of "why?" may be asked, until one arrives eventually at a basic determinant, or motive, which can no longer be questioned; such as hunger, thirst, desire for a mate, desire for approval, and other motives to be discussed in this chapter. These basic motives must be accepted as "given" phenomena of life. If anyone asks why we want to satisfy hunger, why we seek a mate, why we desire approval, why we are communal animals, we should simply have to answer that man is like that; and that further questions are matters for the philosopher; for then we should in fact be asking the question, "Why is life?" The basic determinants must be accepted as the materials out of which human nature is fashioned. On the other hand, we repeat, at the risk of tediousness, that the basic motives and the factors in the environment work together as parts of a single growth process, and that neither one can be said to be more important than the other.

Behavior Motives Depending upon Obvious Biological Needs. In giving their inventories of this type of behavior determinants, psychologists come very much closer to reaching an agreement than they do in the case of "instincts" in general, as pointed out in the preceding chapter. For the most part, the differences that exist are due to the degree of subdivision that they believe should be specified. For example, all writers include in their inventories the "desire for rest." Yet some separate this desire into the fatigue of striped musculature and the need of sleep, whereas others simply list "rest."

In this category of determinants, we are interested primarily in those which have proved significant in the origin and development of behavior. Others—like maintenance of bod-

ily temperature, respiration, avoidance of noxious stimulation to the skin—are, of course, important for the comfort and at times for the survival of the individual. But they are relatively fixed and invariable. Hence, they are much less important to the educator than the following which can be expressed by more flexible and educationally (environmentally) controlled specific manifestations.

There are five determinants or motives of behavior based upon obvious biological needs which, before long in the life of the individual, become the sources of very complex and far-reaching forms of activity. These five are hunger, thirst, elimination, rest, and sex behavior. These, with the exception of sex activity, give rise in their more elementary forms to behavior that is compelling and cannot be denied without serious or even fatal consequences. For purposes of study, they should be distinguished from such behavior motives as curiosity, desire for recognition and approbation and social behavior which, though having their roots in original behavior potentialities, are not so compelling, although they are none the less real and original in character.

Description of Hunger. The physiological aspects of hunger are to be found in nutrition, digestion, and metabolism. Ordinarily, feeding times are rather arbitrarily determined so that infants are nourished from four to six times daily, while adults are nourished regularly three times daily, although there are minor variations in different countries. A person is conscious of his state of hunger as a result of stomach contractions which are the antecedents that evoke the hunger experience.[4] He becomes aware of a "gnawing" feeling. The infant may kick and move restlessly, and perhaps cry; the adult may grow restless, making numerous bodily movements; and for a time even the intensity of his responses in general may increase. There is a general in-

[4] Cannon, W. B., "Hunger and Thirst," chap. 5 in *A Handbook of General Experimental Psychology* (C. Murchison, editor), Worcester, Mass., Clark University Press, 1934.

crease of visceral tension.[5] After feeding, the organism being in a state of distention and repletion, and physiological tension having ended, the "gnawing" disappears, and a state of relative quiescence ensues. Feeding involves sucking, biting, chewing, swallowing, and peristalsis. For these purposes, efficient muscular activity and, later, teeth are necessary. And, finally, the acquisition of certain skills is necessary, as in the handling of the implements of feeding, however crude these may be.

This bare outline might be adequate as an enumeration of factors if hunger and feeding had no significance or implications for behavior beyond the mere routine of satisfying physiological wants. But feeding is an important determinant of behavior in other respects which are principally psychological. For, important though the physiological processes are, the psychologist is more interested in behavior which accompanies and develops out of activities originally directed to the satisfaction of hunger. The student of child psychology, especially, wants to know why children eat as they do, and how children's eating behavior is related to social life, beginning with the mother and family. The child in an eating situation—and, for that matter, the adult—does *not respond simply to the food which confronts him; he* responds, instead, to the total environment perceived by him at the time. And in this respect as in others, his behavior at any particular time is the result of his innate feeding responses modified by growth; that is, by maturation and learning.

As an illustration of the child's behavior to the total environment in eating, we may cite the following case.

A mother has taken a year-old child away from play and wants to feed him on her lap. He does not want to eat. He is at the moment dominated by the tendency "away from eating" or "toward play." The mother holds the child on her lap and prevents

[5] Wada, T., *Hunger in Relation to Activity*, Archives of Psychology, no. 57, 1922.

the intended movement "away from eating." She puts her arm around him so that he cannot break away. The mother's interference has in this case the character of a barrier between the region of eating and that of play. This barrier at the same time keeps the child from pulling away from the spoon as it is brought near his mouth. The child now begins to play on the mother's lap. The mother tries to put an end even to this possibility of action and limits the child's space of free movement still further. Thereupon the child tries to widen his region of free movement and begins to struggle with the mother.[6]

This illustration is interesting and illuminating, for it shows not only the child's response to a total situation, but it points as well to the complex character of eating habits. It suggests a possible source of conflict and the development of a negative attitude toward feeding or toward particular foods. It suggests also the possible beginnings of a negative attitude which might spread to other situations in which the mother is involved. In other words, here we have a case which has the possibilities of developing into a "problem"; for eating is not merely a physiological matter but involves also a volitional aspect within a social setting. It is not difficult to think of comparable situations in the eating behavior of older children and adults.

Modification of Eating Behavior. At birth the normal infant possesses behavior patterns adequate to enable it to make a satisfactory adjustment in a feeding situation. It can turn its head, adjust its lips, suckle, and swallow (all being aspects of a single process of behavior), thereby initiating the entire digestive process. These responses, at first, are adequate for the purpose and are unlearned.[7] Feeding, then, is an innate form of activity to begin with and is dependent upon the proper degree of physical maturation.

[6] Lewin, Kurt, *Principles of Topological Psychology*, New York, McGraw-Hill, 1936, p. 47.

[7] There are rare cases of infants, not necessarily subnormal, who apparently have to be taught and cajoled to suckle. It is possible that organic defects or immaturity might account for these exceptional cases.

This latter point is demonstrated by the incompleteness of premature infants' feeding behavior.

An individual's behavior in satisfying hunger is modified as he grows older, due to maturation and learning. The appearance of teeth makes possible the use of solids in the diet; development of musculature and nervous system permits the use of a cup instead of a nipple, the employment of knife and fork instead of the hands alone. The foregoing, plus the development of intelligence, make it possible for the individual to learn how to satisfy his hunger in a manner consistent with the practices of his society.

In making the transition from mere sucking to the use of a cup, and later to the use of spoon, fork, and knife, it is important that specific training be provided at the proper time in the infant's maturation—neither too early nor too late. In this respect, learning to feed oneself follows the same course of development suggested in the preceding chapter, in the discussion of maturation and learning. If the training is begun too early, the infant will resist the new form of activity which the adult is attempting to impose. If it is begun too late—say, at the age of two years or more—the child will be disposed to resist for two reasons. First, the task is not challenging enough and is, therefore, uninteresting. Second, the child has built up an attitude of dependence upon the mother (or upon whatever person feeds it). It apparently finds satisfaction in that attitude while, at the same time, it has control over and attention from the adult, such as would not be possible if the dependent behavior were replaced by an attitude of independence.

Social Influences on Eating. These are, of course, aspects of learning, but they are sufficiently important to warrant special consideration.

From the very first the human organism's rhythm or frequency of feeding is determined by the practice of his society. Of course, there are limits set by the organism's biological needs; but within those limits much variation is

possible. Consequently, the particular routine to which the infant, child, or adult becomes accustomed helps to determine at what particular times of the day—or night—he will seek to satisfy his need for food, under ordinary conditions. In this way the method of satisfying the hunger motive becomes stereotyped through practice and learning. Thus *habits* of behavior develop from motives or basic determinants of behavior.

When the child passes beyond the suckling stage, he is confronted, in eating, with a series of successive social requirements to which he must make adjustment. He must learn to use a cup, a spoon, a knife and a fork, and perhaps variations of these instruments, depending upon his social status. He must eat certain prescribed foods rather than others. He must learn the routine of "washing up" before meals. He must acquire the use of a napkin. He must become accustomed, perhaps, to delaying his eating until his parents have begun; and perhaps grace must first be said. The several dishes must be eaten in a given sequence. There are restrictions against noisy practices during eating. "Talking at the table" might be prohibited. And finally, having finished his meal, perhaps the child must learn to wait until all are done.

Educational Implications of Hunger. Educationally, it is essential that we recognize the arbitrary character of these customs, or aspects, of eating. They are not biological essentials; they are socially imposed, and the child must learn to conform. Unfortunately, it is not possible at present to give a complete educational formula for instructing the growing individual in how to make the necessary social adjustments in the process of satisfying this basic physiological need. Here again, psychological *theory* is sound and accepted; but the details of its application are difficult and not too certain. However, this much can be said: since the infant or child responds to its total environment, the feeding experience itself should be made pleasant and satisfying from the first,

effecting on the part of the child as many "acceptances" as possible, and avoiding conflicts. This refers not only to the child's sense-modalities; but it means that the child must be directed gradually, that he must perceive for himself, that he must take things in his stride.

Furthermore, the development of eating habits has something to contribute to the individual's total personality. For, with increasing age, children must develop more and more responsibility for and independence of behavior in all things. Therefore, the development of an attitude of responsibility and independence in the matter of eating can have widespread significance in the development of other behavior forms which are concomitant with or subsequent to the development of eating behavior. Attitudes which are developed in one sphere of activity are not restricted solely to that sphere; they can transfer to others as well.

Educationally, also, the development of eating behavior—and of all other forms of behavior—is significant beyond the immediate activity itself, in addition to the matter of attitude mentioned above. Learning to use a cup, a spoon, etc., contributes to a child's motor development and skill; for such learning supplies additional opportunities for the exercise of bodily structures and functions and thereby contributes to their development. Here again we may refer to the experiments already cited in regard to maturation and learning. The principle is the same as in the development of walking, climbing stairs, and the others. Furthermore, the child inevitably acquires some or all of the vocabulary necessary in an eating situation.

The proper training in eating behavior, therefore, results not only in developing effective means of satisfying hunger. It provides opportunities for the development of desirable attitudes; it contributes to the development of motor skill; it provides situations and opportunities which should stimulate the growth of the child's vocabulary.

Social Significance of Hunger in Adult Life. The significance of hunger as a behavior potentiality does not end with childhood; nor with the rhythm and technique of eating in adulthood. The eating situation may and often does become a matter of great social importance. Festivals and holidays attending harvesting time are woven into the very fabric of a social system. Certain foods may not be eaten at certain times specified by religious groups. The presence or absence of one or another kind of food or drink at a formal dinner stamps the host as a member of this or that social stratum. The quality and variety of silverware, dishes, and linens are criteria of social position. Table decorations have social value as well as esthetic. Serving meals has been formalized and stereotyped; and deviations from the formula will make guests' eyebrows rise. And, finally, guests must be seated in a given order of seniority. Violations or differences of opinion regarding the proper order create social "crises" and may even have diplomatic "consequences," if a violation or error occurs at a state dinner or reception. The hunger motive thus comes to be interwoven with social behavior and with a desire for recognition and approbation.

Eating Maladjustments. By the term maladjustment we ordinarily mean the solution of a problem in a manner which is not customary or approved by adults. But when a child "maladjusts" to a situation, there is a reason, whether it be in satisfying the hunger motive or any other. Unless it is a case of actual physical difficulty, the reason will usually be found in the situation external to the child; that is, the environment. The causes may include faulty routine, premature attempts at training, the creation of conflict situations between adult and child. And very often, indeed, the "problem" is due to the fact that the child quickly perceives he can use the meal as a means of gaining attention and solicitude of its parents; a form of self-assertion exercised by the child. "Maladjustments" become understandable when we view them in the light of complex motives, and when we recog-

nize that a particular kind of adjustment or maladjustment is the result in part of the environmental complex in which the child develops.

Stealing, class strife, and international war also may be regarded as individual and social maladjustments often directed to the satisfaction of the hunger motive in the beginning.

From the foregoing rather long discussion of hunger, it should be clear that a behavior potentiality appearing in infancy as a relatively simple, direct, and uniform activity has numerous possibilities of development. It comes to be interwoven with complex social implications and often loses its identity in the new behavior complexes of which it has become a member. We have discussed the hunger motive at length not only because it is a fundamental and imperative need, having physiological and psychological significance, but also because the principles developed in that discussion are valid for the other motives having obvious biological bases.

Thirst, Elimination, and Rest. Like hunger, these three biological needs have their sensory aspects. Thirst and elimination have their localizable and perceptible sensory experiences. In the case of the need for and the attainment of rest, however, localized sensory mechanisms and experiences have not as yet been possible of determination. For the satisfaction of each of these needs, the child is equipped with innate forms of behavior more or less adequate at birth. These forms, of course, undergo development as the child matures and is subjected to training in the home. In thirst, the actual process of swallowing undergoes very little change throughout life; but there are changes in the utensils used and in the liquids drunk. In elimination, training is directed largely to matters of control, sanitation, and the observation of social taboos. In rest, training is concerned principally with establishing the proper rhythms of sleep and relaxation.

Since these three biological needs, like hunger, also develop in a social setting beginning in the home, they have implications which transcend their immediate satisfaction. All three are potentially pleasurable experiences, but maladjustments do occur. However, unless there is actual physical abnormality when maladjustment occurs, undesirable behavior is symptomatic of poor training or of a difficulty in connection with which the maladjustment is merely a means of attaining an end not inherent in the satisfaction of the biological want in question. For example, enuresis in some children is a means of getting recognition. It often disappears in such cases when the child's environment is changed or when the cause of maladjustment in the home is removed.

Child psychologists are quite well agreed that in the development of the modes of behavior satisfying the biological needs thus far discussed, the first five or six years of life are extremely important. Of course, some of the more complex and remote social aspects develop later in life; but many of the basic aspects are due to training in these earliest years. This being so, the importance of the home as an educational institution is apparent. In respect to the foregoing forms of behavior, the nursery school has one of its special functions; and their proper training has been one of the nursery school's major and legitimate concerns.

Sexual Behavior. The fifth of the motives having an obvious biological basis, sex, is of fundamental importance; though it does not have the same imperative character as the first four. If the demands of hunger, thirst, elimination, and rest were denied beyond a critical point, the results would be fatal. Sexual behavior, originally, has its physiological tensions in the gonads, striped muscles, and erogenous zones. If, after puberty and during adolescence and adulthood, all sexual behavior is suppressed and inhibited, the entire personality may be affected, resulting at times in pronounced distortions of personality, although it is very probable that

the frequency of consequent neuroticism has been exaggerated.

Sexual interest and behavior are not activities which appear suddenly at puberty, and without antecedents. On the contrary, erogenous zones respond to direct stimulation from earliest infancy. During childhood, stroking and caressing produce vague and diffuse states of pleasantness and satisfaction; self-exploration is a common and normal practice. In later childhood interest in the opposite sex is manifested by "showing off" and by shyness.

Biological maturation proceeds until the age of puberty when the individual is capable of mating, and the sex motive, assuming a new form, becomes stronger than it was earlier. At this stage, and subsequently, secretions of the ductless glands—especially of the gonads—produce bodily changes, the secondary sex characters. It has been suggested, also, that these secretions are very probably responsible for changes in the expression of the sex motive. The secondary sex characters, such as changes in bodily proportions and symmetry, changes in voice, growth of beard, etc., contribute to the reciprocal interests of the sexes. But social control is imposed and sexual behavior is suppressed until marriage. However necessary and desirable such control is, its arbitrary character must be recognized. In this, as in other motives, the details of its manifestations vary with different cultures. Sex attitudes are derived from the social environment. Notions of propriety, decency, and morality are created through education in the home, church, school, and the general community. For example, among the Trobriand Islanders,[8] who are not unique in this respect, complete freedom of sexual activity, within the limits of exogamous taboos, is allowed to boys and girls from adolescence onward. In their culture such a practice is feasible because the responsibilities of parenthood are easily discharged under their simple eco-

[8] Malinowski, B., *Sex and Repression in Savage Society*, New York, Harcourt, Brace, 1927.

nomic system. Yet, in other primitive groups, the strictest prohibitions are imposed. In our own society, precocious parenthood is undesirable because often it would impose an impossible economic burden and would interfere with the parents' preparation for economic usefulness and independence, especially in the professions. To this economic restriction have been added religious, moral, and legal restraints.

Since the mature form of the sex motive cannot at first find expression under our social and economic order, the usual practice is to reorient the individual, to set up other goals for his or her behavior, to establish and foster new and realizable goals which may be achieved through acceptable modes of conduct. That is, motives other than sex are emphasized. Such redirection of energy, interest, and activity is called sublimation by some, whereas others prefer the term "alternative response." [9] But the sex motive in sublimated form also utilizes dancing, sports, and other social contacts; that is, a new pattern of behavior is substituted for the original one. By means of the process of sublimation it is possible to substitute a mode of behavior which offers a significant outlet to an otherwise tantalizing craving for expression and activity.[10]

Thus, the original undifferentiated response of love or contentment in infancy differentiates itself by maturation and learning into various specific forms. Physiological maturation, of course, is essential; but some of the details of and the values attached to sex behavior are matters of learning as determined by the culture in which the individual develops. Nor are the learned aspects solely matters of

[9] See Taylor, W. S., "Alternative Responses as a Form of Sublimation," *Psychological Review*, vol. 39, 1932, pp. 165-173.

[10] Practically all the work on sex tensions has been done with animals. See Wang, G. H., *The Relation between Spontaneous Activity and Oestrous Cycle in the White Rat*, Comparative Psychology Monographs, vol. 2, no. 6, 1923; also Warden, C. J., *Animal Motivation*, New York, Columbia University Press, 1931.

taboos and values. The sex motive is originally a matter of physiological tensions; but later the stimulus may be ideational. Learning in this respect is not unlike the learning in any other of man's numerous activities. That is to say, we begin with the immediate concrete situation giving us sensory experiences; but at a later time substitute stimuli in the form of words, pictures, or ideas are sufficient to evoke an adequate response. For example, with most persons the mere word "pickle," as a result of experience, is enough to cause a flow of saliva and swallowing.

Esthetic values may also develop in connection with the sex motive. In one society brunettes are preferred to blondes; in another the stout may be preferable to the slender. In one society the clean-shaven male is idealized; in another the rich hirsute adornment is esteemed. Attire and adornment of men and women, in both color and form, have their sexual significance, although this is not the sole basis of adornment.

The sex motive, like the hunger motive, assumes social significance beyond the pragmatic economic, religious, and moral, as indicated above. In some of our own societies, a man's social position is in part dependent upon the splendor in which his wife is adorned, and the frequency with which the adornments can be changed. In woman, inability to bear children, and in man, impotence and sterility provoke scorn. Spinsterhood in our society is regarded as merely undesirable, while in primitive and peasant societies the childless spinster is an object of contempt.

Since the original potentiality for sexual behavior has important esthetic, religious, moral, and economic implications, it thereby becomes an important educational matter. The earliest training is a responsibility of the parents primarily, and possibly of the early years of schooling, including the nursery school. Later training, particularly at puberty and during adolescence, when sublimated or alternative activity assumes its greatest importance, is the responsibility of the

secondary school as well as of the home and parents. The problem is one of forming habits conducive to hygienic living, both mental and physical. To achieve this end, control and direction must be based upon intelligent choice, arrived at through instruction by parents and teachers. The medium for the cultivation of intelligent choice is a wholesome and scientific atmosphere surrounding sexual behavior as a major human motive having its normal, healthful, and esthetic aspects.[11]

Parental Behavior. In the chapter on original behavior we pointed out the extent to which the so-called "parental instinct" varies, and that, in fact, it is practically absent in some instances. Yet some psychologists hold that parental behavior is innate and a basic propensity. It is undoubtedly true that this behavior is found in some animals lower than man, manifested in procuring food for and affording protection to their young. For example, the higher insects—such as wasps, ants, bees—provide a store of food for the grub in some instances, or, in others, feed the grubs from day to day. However, there are lower insects—e.g., moths and butterflies—which must support themselves as soon as they emerge from the egg, since the parents do not supply any food. Similarly among birds, some must care for themselves immediately upon emerging from the egg; for, like the chick, they can run about and pick up food. Yet the young of other birds (presumably the higher birds) are helpless for many days, being fed and protected by their parents. Among the mammals everyone has observed maternal care during the nursing period and even for a short training period after that. Their young are quite helpless to begin with but gradually attain independence. On the other hand, there are instances when some of these animals desert or

[11] For further details of the several aspects of the sex motive, see Allen, E. (ed.), *Sex and Internal Secretions*, Baltimore, Williams and Wilkins, 1932; Bigelow, M. A., "Sex Education and Sex Ethics," in *Encyclopaedia of Social Sciences*, vol. 14, pp. 8-13; Conklin, E. S., *Principles of Adolescent Psychology*, New York, Holt, 1935, *passim*.

destroy their young. On the whole, however, there seems to be a relationship between parental care and the degree to which the young have approached their full mental development at birth; that is, animals whose young have the longer periods of immaturity and helplessness, which are therefore relatively less mature at birth, provide, on the whole, more parental care. During this period of immaturity and care the young are not only provided for, but they learn certain kinds of behavior from their parents.

But even if parental care were universal in infra-human animals, that would still not mean that the same were or need be true of man himself. Man's behavior in this respect is too variable to permit an easy generalization. In order to circumvent this difficulty, some psychologists view parental behavior as an aspect of sex behavior. But this notion, though it can be supported up to a point, also encounters difficulty. It is argued that since children result from sexual mating, parental care, therefore, being subsequent to mating, is associated therewith and perhaps derived therefrom. However, there are persons with strong sex impulse but without parental interests. On the other hand, there are persons with weak sex impulse but with strong parental interests.

Other psychologists would place parental behavior under a quite different head: namely, sympathy. In addition to care of children, they cite as examples: care of aged, care of pets (dogs, cats, birds, etc.), charity, philanthropy, and the like. Yet, contrariwise, man, without compunction, slaughters a variety of animals for food; he slaughters his fellow man in wars he does not understand; he persecutes and exiles his fellow man on irrational grounds; and he readily exploits his neighbor. Also, some parents abandon their young, or punish them severely, or abuse them, or exploit them. Furthermore, the notion of parenthood as a basic propensity is weakened by the widespread use of contraceptive methods in our own kinds of societies and, when there is an excess of

population, by the practice of infanticide in other societies. Sympathy as a basic propensity, therefore, also faces many objections.

The dilemma we face in accounting for parental behavior is obvious. It is admittedly a less clear and more puzzling form of behavior presenting uncertainties and contradictions which are not readily accounted for as are the apparent (but not real) contradictions in such forms of behavior as acquisitiveness and non-acquisitiveness. It is possible, however, to regard parental behavior in man as a potentiality subject, like all others, to cultural influences, even to the extent of suppression. But unlike hunger, thirst, and mating, parental behavior is not insistent or compelling; and in its development and expression it must compete with others which are of greater force. But whether this view is acceptable or not, this much is clear: most human parents, once having accepted parenthood, strive to protect their young and to develop them fully, giving them sympathy and affection. In a society where children are cherished, providing for them and bringing them up becomes a strong incentive for a large portion of the activities of their parents.

The Nature of Curiosity. Curiosity may be regarded as a basic behavior potentiality or motive, even though it does not have the very imperative character of such motives as hunger and thirst. Unlike hunger and thirst, a specific organic basis has not been demonstrated in the case of curiosity. But even though it does not have a clearly demonstrable organic basis, students and observers of infants' and children's behavior generally recognize that curiosity is a motive which characterizes the human organism as a seeker and an experimenter. The infant, child, and adult show an interest in the new, a desire to learn, a spirit of discovery and adventure, provided the task or situation is at the proper level of difficulty; that is, neither too difficult nor too easy. The task must be within the individual's apprehension. At the same time it must present to *him* a problem, a challenge;

and it must offer the possibility of obtaining satisfaction through a realization of his own progress. The principle, then, is to provide an environment which will furnish the individual with a desirable and attainable goal.

Little is known in regard to the infant's awareness of his environment during the earliest days of life. At the very first he has very little co-ordination of movement; he gives slight attention to his environment. His gaze is uncertain and apparently aimless, and his adjustments are of the most elementary kind. But within a few months observers note a progressive change. The child develops an awareness of his environment and himself; his behavior becomes more precise and directed; the parts of his own body and objects external to it (rings, rattles, noises, persons, etc.) evoke behavior *which implies curiosity. Later still, the child* manipulates objects; he bites, tastes, scrutinizes, pounds, and tears up. When the child is able to crawl and creep, his range of activity is increased; he can then explore; he can approach whatever arouses his curiosity. His experiences are thereby increased; there are more interesting external objects to be manipulated, heard, watched, touched, or otherwise experienced. Almost any new object will attract him: tobacco smoke, blocks, animals, the sound of a musical instrument. Later when he has learned to talk, the child explores with language. This is the questioning or the "why?" stage. And when he has learned that objects have *names*, he arrives at the "what's that?" stage. Progressively, his behavior is more and more directed to objects and their control. It is a development of this behavior that leads to invention or creation. The basic principle is the same from childhood to adulthood. Curiosity may be regarded as manipulatory activity in infancy and early childhood; and it is activity from which satisfactions are derived. These satisfying activities stimulate a desire for their recurrence. Later, however, curiosity appears also in the form of higher mental processes and as implicit activity, rather than explicit. That is to say,

in its later manifestations, curiosity is concerned with concepts, principles, and less immediate phenomena. Naturally, these later manifestations require ability to deal and reason with abstractions—language, number, and other symbols.

Curiosity and Education. Curiosity opens the way to education; it is a motive for discovery and learning. As already stated, children can be attracted by and become interested in a multitude of things within their range of apprehension. Some psychologists even have maintained that children can be interested in all things. As the child grows older and acquires more and varied experiences, an increasing number of aspects of his environment are heeded; and he tends to order or systematize his environment. This being so, the importance of an adequate and stimulating environment is obvious; for the growing individual's curiosity must have something to work upon.

The same environment, however, does not necessarily develop the same activity in all children. For example, a child with very good auditory discrimination will, because of his sensitive hearing, make nicer discernments of pitch and tone, and perhaps discern rhythms and melodies unperceived or less well perceived by other children. He has superior equipment and potentialities for the study and learning of music. The color-blind child, obviously, will show less interest in painting than the child of normal or superior color-vision. The verbally gifted child begins earlier than most to direct his curiosity to learning the alphabet and to reading.

The child, in his early activity, does not demand by-products in the form of rewards of one sort or another. The activity, discoveries, and consequent satisfactions themselves seem to be sufficient. This contains at least a suggestion for subsequent learning in home and school, when it often seems so difficult to motivate learning. If the situation is new and challenging and of the proper degree of difficulty, with emphasis placed upon the possibilities for creative effort, activity and learning will be stimulated. It has often

been observed by teachers at all levels that pupils are motivated by problems they can apprehend; problems whose ends or goals they can appreciate. The outcome need not be practical; nor need there be threat of punishment, nor promise of reward.

The "unit system" of instruction satisfies at least the preceding conditions of curiosity. For the unit is presumably an activity which is within the pupil's range of interests and abilities. Furthermore, the unit can be grasped as a whole by the pupil; he is able to understand what he is doing, and why. Also, the pupil perceives the goal toward which he is working and experiences the satisfaction of completing a task whose goal he had in view from the beginning.

Relation of Curiosity to Constructiveness and Collecting. At times these are specified as independent and original "instincts" or motives. It appears, however, that they are but particular expressions of curiosity. It is natural that a child who is given blocks, picture puzzles, plastic materials, mechanical toys, tools, and the like, should do what he can with them in the course of his explorations. What the child or adult does with the objects before him depends upon the inherent qualities of the objects and upon his discovery of their possibilities. This eventuates at times in what has been called constructiveness.

Collecting may be explained also as a result of curiosity operating in the individual's particular environment. Investigations have shown that making collections is not a universal trait of children, and certainly not of adults. In 1903, one study indicated that ninety percent of the children investigated were making collections of one sort or another. In 1926-27, however, other investigators reported that only 11 percent of a group of children were making collections. A still later study, by the authors of the latter report, showed that a larger percentage of children were doing so. They concluded, therefore, that making collections is dependent

upon sex, age, locality, and season.[12] In other words, collecting may or may not be a result of the functioning of curiosity in a given milieu. And when collections are made, it will be found that the particular items collected are an expression of the individual's interests, of which curiosity is the source. This motive, expressed through collecting and constructiveness, will serve practically to direct the attention of both parent and teacher to a useful means of interesting children in the acquisition of true knowledge and skill by leading them to organize materials they collect, by pointing out new directions to follow, and by providing opportunities for constructions requiring progressively more precise manipulations.

In curiosity—again as with hunger, thirst, sex, etc.—we have a motive to behavior the manifestations of which become more complex as the individual matures and as all his behavior forms assume significance with respect to other motives, particularly the social. The child who, out of curiosity, starts a collection may find himself involved in competition for recognition and approval of the group by having the largest or the rarest collection. Another child, in school, finds that his achievements resulting from his curiosity bring by-products in the forms of recognition and rewards. Or, on the other hand, failure to pursue an undertaking to its successful conclusion may bring censure and punishment. Or, again, an explorer or scientist finds that he has become a "social lion"; in which case the desire for discovery—perhaps originally motivated in part by desire for recognition—has become a factor in gaining approbation. Or, considering behavior of the earlier years, we find that some of the child's activities must be directed by social demands, as in learning arithmetic, writing, and reading; in

[12] See Lehman, H. C., and Witty, P. A., *The Psychology of Play Activities*, New York, Barnes, 1927; Ragsdale, C. E., *Modern Psychologies and Education*, New York, Macmillan, 1932, p. 108; Whitley, M. T., "Children's Interests in Collecting," *Journal of Educational Psychology*, vol. 20, 1929, pp 249-261.

which case curiosity may be utilized for developing individual and social competence through the social values attached to selected performances and their mastery. The difficult but by no means forbidding educational problem, then, arises in directing the learner's potential curiosity into those fields regarded as individually and socially desirable. In short, curiosity can be interwoven with other motives and hence used for educational purposes.

Desire for Recognition and Approbation. The desire for recognition in one's social group is a universal and dependable motive in human behavior. It is the desire to be well thought of, to have the approbation of, and to enhance one's standing in his group. But the *particular manner* of obtaining recognition is not prescribed by nature. The manner of achieving approbation depends upon the *mores* (customs regarded as right and vital) and practices of the culture in which one develops; for behavior is guided by the wish to possess or at least to appear to possess to a conspicuous degree the qualities upon which one's social group places value.[18] In our own society, for example, this tendency is shown in the striving for and value placed upon medals, decorations, uniforms, "honors," and public distinctions. It is manifested, also, in the struggle for leadership and for the acquisition and accumulation of wealth, whereas in certain primitive societies these particular forms are absent. In our own society, scientists, scholars, and artists, although devoted to the enrichment of knowledge or to esthetics itself, nevertheless are desirous of having the discerning approbation of experts in their own fields.

The desire for recognition is present in individuals of all ages, from earliest childhood through adulthood. The young child wants attention; he resents neglect; and often he will

[18] See Klineberg, O., *Race Differences*, New York, Harper, 1935, chap. 14. Also Benedict, Ruth, *Patterns of Culture*, Houghton Mifflin, New York, 1934. For an example of the absence of leadership or mastery, see quotation from Rivers, W. H. R., *Instinct and the Unconscious*, in Ogden, R. M., and Freeman, F. S., *Psychology and Education*, New York, Harcourt, Brace, pp. 71-75.

strongly resent the greater care and solicitude shown a brother or sister. He cries and complains if for any reason he is left out of the play of his group. It has been reported that the desire for recognition can be distinguished in children from the second year on. At times, behavior problems in children are traceable directly to their efforts—often unconscious—to gain recognition and attention by indirect means when direct satisfactions are not available. Tantrums, hysterical symptoms, compensations, rationalizations, regressions, and the like are evidences of indirect means of gaining recognition.[14] In extreme instances, this desire may even find expression through delinquency. It is not to be assumed, however, that all maladjustments in children and adults can be readily and simply explained in terms of a desire for recognition or approbation; but the fact is that this motive is a powerful influence in behavior.

Day dreams, night dreams, and fantasies are indirect means of satisfying the need for approbation when such is not available in actual life. These are quite common in children, as the publications in the field of mental hygiene eloquently attest. For their fantasies, children create imaginary companions who admire and applaud them, and follow their directions, and before whom they give performances of one sort or another. Very often it will be found that such fantasies occur in children who for various reasons are out of the life of their school or local group. Ordinarily, of course, these fantasies disappear as the child grows older and gets its satisfactions in actual accomplishments. Day and night dreams are concerned with achievements which will bring recognition. One child, for example, often dreamt that he was reciting poetry in front of his chums at school and that they were cheering him. "This," he says, "is different from real life. I have never been praised for recitation." [15]

[14] These are discussed in chap. XIII.

[15] See Green, G. H., *Psychanalysis in the Classroom*, New York, Putnam, 1922; especially chaps. 2, 3, 4, 5.

Adolescent boys see themselves as great athletes; adolescent girls see themselves as "movie" actresses. Many college students suffer strong emotional reactions if they fail of election to a desired fraternity. Election to honorary scholastic and scientific societies is often the principal incentive for hard work in college studies. Parents will slave so that their children may have what others have, or so that they may gain prestige by living on the "right side of the tracks." In our culture, business and industrial competition will be carried to destructive extremes because "survival of the fittest" is assumed to operate in economic life. These and many others that could be specified are particular forms in which the basic motive for approbation is manifested in our society. Just as these are the results of our social forces acting with and upon the motive, so social forces of a different sort could produce other specific activities quite unlike those now found in our culture.[16]

Relation of Recognition to Education. There are several very important implications for education in the desire for recognition and social approbation. First, it is obvious that educational institutions, including the home, are in a most significant position to determine what particular forms of behavior shall enhance a person's prestige, and, conversely, which shall evoke the contempt of one's fellows. In other words, these institutions fashion or give specific form to this general basic motive. In the second place, awareness of the importance of this motive will often yield insight into the behavior problems of many children. Through recognition and approbation, children, as well as adults, achieve a feeling of security, of belonging, and of accomplishment. Conversely, persistent failure in the school or elsewhere denies satisfaction to this motive and may lead to indirect or undesirable efforts to meet the need. The importance of this motive is relevant to individuals of all levels of mental

[16] For a discussion of social values, see Freeman, Ellis, *Social Psychology*, New York, Holt, 1936; especially chaps. 9 to 13 inclusive.

ability, with the exception of the lowest of the mental defectives who are incapable of apprehending a social situation.

It is apparent, therefore, that modern school practices of grouping children according to mental ability is psychologically sound not only from the viewpoint of intellectual capacity, but from the viewpoint of basic human motives to behavior and their emotional concomitants. The dullard in an ordinary classroom is mystified, and his failure brings him censure instead of recognition and approval which he wants. In a special class made up of his equals, his "behavior problem" often disappears, and he shows a renewed interest because he is doing something that gives him a sense of achievement, enhances his self-respect, and brings approval instead of censure or ridicule. The gifted child, on the other hand, is affected adversely by being in a mediocre class where mediocre tasks are assigned to him. Easy performances and easy success in his case bring easy prestige. This may result not only in habits of indolence, but it is bad training for later life; for the gifted child accustomed to easy success in school will expect easy conquest and distinction in adolescence and adulthood. A full realization of the importance of this motive implies a knowledge of and provisions for individual differences in mental capacity, both educationally and vocationally.

General Character of the Social Motive. Social motivation and behavior are not conceived of as a form of activity distinct from and independent of the other behavior forms already discussed. Enough has been said in the preceding pages to show that almost from the day of birth all activities are socially significant and socially directed. This is especially true of the recognition and approbation motive which, naturally, has no meaning in any but a social setting. However, we are justified in treating social motivation independently because man is a social organism; he has the capacity for social adjustments which he must make; and as a member of a group he is capable of and engages in behavior

which would be unknown to him or even repudiated by him as an individual acting in isolation. That is, persons in groups execute certain types of activity because they *are in* the group and are affected by others in it; as, for example, in war hysteria, mob attacks, and "revivals." Thus group membership and behavior are significant apart from the independent existence of the individual. It must not be supposed, however, that there is something mysterious or extraphysical about a group. Obviously there can be no groups without individuals. The important point is that the *potentialities for group behavior are within the individual who is the executant, or participant; but membership in the group is a necessary condition for the expression of those potentialities.* The individual's behavior modifies and is modified by others who are spatially present or who can be thought of as present.

Social intercourse, the impact of person upon person, individual upon group, and group upon individual—these develop social traits and personality. Morality, self-consciousness, humility, aggressiveness, altruism, selfishness and any of the other traits that have social importance do not develop in isolation. They develop in a social setting, and as personality traits would mean nothing apart from other human beings. They, among others, reveal man's potentiality for making social adjustments.

The satisfactions and contentment that persons get from social participation are shown by the fact that without the presence of others, they, with certain relatively few and explicable exceptions, become restless, uncomfortable, unhappy, and begin to seek contentment in the company of others of their kind. Man's earliest satisfactions and comforts are brought about by the presence of others, and he continues in his desire for sympathetic contacts. His first experiences, ordinarily, are in a family group; he then enters the nursery school, kindergarten, elementary and secondary schools, and perhaps college. He becomes a member of a

gang, and later of labor, social, religious, and professional groups. Thus, the presence of others becomes essential to contentment and to his fullest functioning. In groups, both society and the individual benefit because through wide co-operation the individual attains means for maximal functioning; and he is able to perceive this fact. All individuals except the lowest of mental defectives are able to apprehend emotionally or intellectually the significance and values of group structures and group participation, and they are able usually to adjust within the social structure. This is the potentiality for social behavior.

Our previous discussion of nature and nurture, maturation and learning, applies here. It would be pointless to argue the question of whether man's social behavior is a matter of *either* heredity *or* environment. Such behavior is obviously and demonstrably dependent in part upon the environment in which the individual develops and upon the stage of his development. And there must be some basis or bases, however complex, in the nature of man to account for his universal socialization; for otherwise the mode of living developed by him would have been solitary rather than communal.

Development of Social Behavior. Only within relatively recent years has the growth of social behavior been carefully studied from infancy, the principal findings being the following. Contact between two children is established beginning in the second half-year of life. During approximately the first five months, infants are apparently unaware of each other when placed near each other. But at about six months the normal child begins *actively* to look around him and *actively* to attract another infant's attention. He *initiates* contacts not only when he needs help but in simple play situations. However, during the first three years of life, social behavior, if it may be called that, is limited to groups of only two, for it appears that the very young child is

unable to maintain relationships with more than one other individual at a time.

In the nursery school, we find the size of the groups increasing with age, group formations being spontaneous. Completely isolated behavior is very rare, and by the age of seven years there are no children who are entirely isolated in their activities. In fact, observers in the nursery school report that children often respond strongly and emotionally against exclusion from a group. Not only is there progressive development of social groups in the nursery school, but children attending them manifest more rapidly and more fully those traits which are regarded as having social merit, such as initiative, cheerfulness, orderliness, sympathy, etc.[17]

In the first grade of school—that is, between six and seven years of age—groups enlarge still more, although the class does not yet act as a whole. A number of groups form within the classroom. But by the time children have reached the fifth grade—the average age being ten to eleven years—it is obvious that the group often does act as a whole. It has been observed, also, that between the ages of eight and ten boys often form groups that have names, organization, and purpose. Finally, in adolescence the "gang" is a common occurrence and seems to be a transitional need of the adolescent.[18]

The obvious conclusion to be drawn from this brief sketch of the development of social behavior from infancy to adolescence is that the individual *gradually* becomes aware of the community or groups in which he develops. His awareness of and participation in the groups depend in part upon the degree in which he is able actually to experience relationships with members of the groups. And it should be one of the primary concerns of early education to provide situations favorable to the development of these relationships.

[17] Walsh, M. E., "The Relation of Nursery School Training to the Development of Certain Personality Traits," *Child Development*, vol. 2, 1931, pp. 72-3.

[18] Thrasher, F., *The Gang*, Chicago, University of Chicago Press, 1929.

It is to be noted, also, that group participation develops during infancy and the nursery school period, and that it starts as an *active* and *spontaneous* process of behavior.

Leadership. In our society and in practically all others, there are the leaders and the led. But these are not two entirely different kinds of persons. The chosen or emergent leader, in a situation not complicated by artificialities and irrelevancies, has in greater amount what others in the group have and want themselves. In other words, a leader has the sanction of the group and is in a sense a product of the group. Contrariwise, a child who is "queer" or "different" is often reduced to the norm; or he may be driven into isolation where his "queerness" is accentuated and his separation from the group becomes more pronounced.

There are, in adult life, notable exceptions where individuals have in one way or another seized and held control by force. But this is not leadership; it is coercion; and if it endures, it does so either by continued threat of force or because it has become accepted and sanctioned. In the latter case it has become leadership because authority and direction have not simply been superimposed but eventually have been made an organic part of the total group.

Observers of the social behavior of children and adolescents note that their leaders are characterized by initiative, ability to organize, and *conformity with the substantial tendencies of their groups.* The leader is able to recognize and direct the main tendencies of the group, while each of the led has his functions to perform and his rôle to play. More than that, in adolescents the leader satisfies certain needs of his followers; he somehow embodies the ideals of his followers. This gives the followers a vicarious sort of satisfaction; what has been called *projection.* These observations in regard to the traits of leaders help to explain what is meant by saying that a leader is sanctioned by and is a product of the group. His development and emergence are con-

sonant with the general nature of the social group in which he functions.[19]

The essential congruity between the leader and the led is strikingly illustrated by the case of a brilliant nine-year-old boy (having an intelligence quotient of 190) who was practically isolated from the group activities of the other children in his school grade, the fifth. He was *in* the class but not *of* it. He held no position of leadership in his own group because he was too far removed from the rest of the class to be understood by them or to establish sympathetic contact with them. Later he was transferred to a special class of superior children whose average intelligence quotient was 164. Within a year he had established himself among his new school mates as an individual of capacity, prestige, and leadership. The members of the new group were much closer to him in intelligence, interests, and sympathies. He was able, therefore, to manifest his potential qualities of leadership in the superior group.[20]

The principle that the development of individuality in a social group must be consonant with the character of the group generally holds no less for adults than for children and adolescents. The development of a scientist would be difficult, if not impossible, in a society which regards his doctrines as heretical; the inventor and his inventions are, to a degree, the product of the society in which he lives; a physician would be regarded with suspicion—if tolerated at all—

[19] In one respect, many so-called "great" leaders among adults sometimes differ from children's leaders. While conforming with the substantial tendencies of their group, they may use their conformity and leadership to *modify* those tendencies. This means educating the group to new values, or enabling the group to make explicit new values already implicit in its behavior. When these values become explicit, the leader still conforms to the group, but it is really a changed group. Among adults, leadership cannot be imposed from without with non-conformity any more than it can among children. The adult leader induces the group to desire what he desires. Thus the "great" adult leader plays a dynamic rôle in shaping the tendencies of the group by initially conforming to the group but then by changing it.

[20] Hollingworth, L. S., *Gifted Children: Their Nature and Nurture,* New York, Macmillan, 1929, pp. 152-53.

in certain primitive societies. The strutting, dramatic militarist is glorified in one society and laughed out of countenance in another. Thus, a man may rise above the mass of his social group to the extent that his capacities permit and are permitted to develop, his social development being a continuous process from earliest childhood.[21]

Motives and Incentives. We distinguish between the motives of behavior and the incentives. The former are the basic determinants of behavior; the latter are the immediate factors in the environment, the achievement of which will satisfy the motive. For instance, incentives include food, water, punishment, reward, praise, reproof, a mate, etc.

There have been numerous studies—with children, adolescents, and adults as subjects—designed to reveal the relative influences of different sorts of incentives upon performance. It would be a mistake to regard each of the special incentives, used in the experiments, as revealing a separate "tendency" in human nature. These incentives must be regarded as the means employed for satisfying one or more of the basic motives. We shall present brief descriptions of a few kinds of experiments to illustrate this point.

The effect of the competitive and non-competitive attitudes upon the quality and amount of work has been judged by comparing two groups, in one of which the members are instructed to *compete* with one another, whereas in the other the members do not receive any such stimulus. The results showed that every subject did much more work in the competitive situation than in the non-competitive. But the *quality* of the work was distinctly poorer under competition than under non-competition.[22] This experiment showed that the attitude adopted in performance is supplied by the

[21] For detailed compilation of studies of the growth of children's and adolescents' social behavior, see Bühler, C., "The Social Behavior of Children," chap. 9 in *A Handbook of Child Psychology* (C. Murchison, ed.), Worcester, Mass., Clark University Press, 1933.

[22] Whittemore, I. C., "The Influence of Competition on Performance. An Experimental Study," *Journal of Abnormal and Social Psychology*, vol. 19, 1924, pp. 236-53.

environment. If quality alone were emphasized the results would have been different. Fundamentally, however, the motive employed here was the desire for recognition and approbation, to be achieved by superiority in quantity or quality, as determined by the standards of the situation.

The effectiveness of rivalry as an incentive has often been tested in the classroom. In one of these experiments,[23] the effect of rivalry was tested with respect to learning arithmetic, the classroom having been divided into groups that competed with each other. After each period of competition, the names of the winners were read, with apparent approbation, and each child rose as his name was called. Further, the experimenter showed on the blackboard the relative performances of the winning and losing groups, emphasizing the degree of superiority of the former and urging the latter to overtake them. As might be expected, of course, the rivalry created between groups and individuals within the competing classroom was effective in producing significant gains over the performance of an equivalent class whose members learned their arithmetic in the usual routine fashion, without added incentives of any sort. But it was not the rivalry *per se* that caused the gains; it was the obvious and emphatic social recognition and sanction that the winners received. The question of what incentives shall be employed is a matter of values supplied by the environment, as this experiment so clearly demonstrates.

Praise and reproof, although not entirely distinct from rivalry and competition, can be and have been studied independently.[24] The technique is practically the same in all studies: some individuals or groups are praised for their performances, others are reproved, and still others are neither

[23] Hurlock, E. B., "The Use of Group Rivalry as an Incentive," *Journal of Abnormal and Social Psychology*, vol. 22, 1927, pp. 278-90.

[24] See, for example, Gates, G. S., and Rissland, L. Q., "The Effect of Encouragement and of Discouragement upon Performance," *Journal of Educational Psychology*, vol. 14, 1923, pp. 21-26; Hurlock, E. B., *The Value of Praise and Reproof as Incentives for Children*, Archives of Psychology, no. 71, 1924.

praised nor reproved. The results, in general, are in agreement. Both praise and reproof are effective in improving performance, although reproof can be detrimental if carried too far. The group treated with indifference made gains—attributable to the normal effects of practice and learning—which were significantly smaller than those of the other two groups.

Again we see the relationship of these incentives to social approbation and disapprobation. In this connection, it is significant that reproof was relatively more effective with bright children who, through being reproved, lost caste; whereas with dull children praise was relatively more effective, for through frequent adverse criticism in the past, reproof had lost some of its potency for them, and praise was an evidence of their improved social status.

In our culture, for the greatest part, recognition and approbation are evidenced in the form of rewards and punishments, which are two sides of the same thing. The school presents a simple illustration. As Lewin points out,

> A good mark has the character of a reward, a bad one that of punishment, and the total situation is such that one or the other necessarily occurs. When the child is faced with an unpleasant school task which will be graded, the tendency to solve the problem as well as possible derives both from the negative [force] of a bad mark and from the positive [force] of a good one.[25]

This principle is equally valid in tasks outside the school, for both children and adults are stimulated by incentives which operate as the means of evoking and satisfying the basic motives to behavior. However, specific rewards and punishments imposed in certain groups are not to be regarded as "natural." If an activity in itself possesses sufficient attraction, artificial rewards and punishments are not essential; for the motives of curiosity and recognition can be satisfied by the doing of the thing and the approbation that

[25] Lewin, K., *A Dynamic Theory of Personality*, New York, McGraw-Hill, 1935, pp. 157-58; also chap. 4.

follows. A situation involving artificially attached rewards and punishments should be distinguished from an interest which has developed in the activity or thing itself.

Mixed Motives. It rarely happens that a situation eliciting behavior involves only one motive, except perhaps in earliest infancy, when the human organism spends by far the major portion of its day in sleep unless it is feeding. But, as already pointed out, feeding very soon is overlaid with social relationships. The young child in the exercise of its curiosity has his social contacts also; and we soon find him seeking approbation, and in some instances assuming leadership. An adolescent's or adult's efforts to achieve social approbation may also have their sex concomitants. The adult, in the practice of his vocation, may be satisfying the hunger motive; but his work may be relevant to curiosity, sex, and social recognition, each motive participating in various degrees of importance, depending upon the individual. The child participates in school work sometimes because he is interested in the activity itself—curiosity; at other times because of promise of reward or threat of punishment, which are means of social approval or disapproval. The college student who has no interest in his studies often works hard at them because failure brings condemnation, or because they are necessary intermediate stages in his progress toward a vocation which will enable him to satisfy the motives of hunger, thirst, and sex, and which will give him prestige. In appraising and interpreting the behavior of anyone, therefore, it is essential to know all the individual and social forces that have been at work.

Reflexes. Thus far our discussion of human activity has been restricted to behavior potentialities and motives which are significant in human development. But there is still another category which must be mentioned: namely, reflexes. These, however, we shall only characterize and mention very briefly, because, relatively, they are not significant in the growth of human behavior, although they are important

experience will be recalled at once. An experience of disgust will demonstrate clearly that in this emotion at least there is a disturbance of the processes of digestion. The disgust not only checks all appetite but may so upset digestion as to result in regurgitation. A little observation and reflection will demonstrate that fear is also associated with digestive disturbances. When one is frightened there is a loss of appetite, and if one tries to eat under such circumstances, whatever is eaten does not digest well.

But in this general reflection upon the nature of an emotional reaction it is important to observe that the quiescent feelings, the happy and contented states, are characterized by quite different forms of the bodily functions from those mentioned above. When one is happy and content, digestion goes on easily, appetite comes normally, and one thinks best, studies best, in such a state of feeling or emotion.

The Physiological Accompaniment. In the above introduction an intimate relationship between feeling and emotion and the general pattern of physiological activity within the body was noted. Now it is wise to examine this physiological relationship more closely. Fortunately much experimental work on this subject has been done in the past thirty years. We have as a consequence much reliable information. First of all it must be understood that these bodily conditions or states are associated with the functioning of a special division of the nervous system of the body. This is known as the *autonomic nervous system.* While it is not to be thought of as separate from the central nervous system, as was believed and taught some years ago, there are sufficient differences in its general structure and functioning to justify its isolation for special consideration. In addition to the nerves from the central nervous system which convey excitations to the striped muscles and the secretory glands of the body, there are yet other nerves which convey excitations to ganglia (nerve centers) lying outside of the brain and the cord. Of these there are many, and from these ganglia,

many of which lie near and just in front of the spinal column, there is a vast spread of excitation to large areas of the unstriped muscles in the walls of the internal organs of the body, and to the ductless glands. It is this group of nerves and their spreading extensions with which we are concerned in the special study of emotions and which constitute what has been referred to already as the autonomic nervous system.

Of this autonomic system it is convenient to observe two divisions, the sympathetic and the parasympathetic.[1] The sympathetic is composed of those nerves of the autonomic system which are associated with the central portion of the cord. The term sympathetic is unfortunate but is retained because of its historical association. There is nothing essentially "sympathetic" about this division and its functioning. The parasympathetic is composed of those portions of the autonomic system associated with the cerebro-spinal system (brain and spinal cord) by connections above the cervical and below the lumbar enlargements.

Activity of the parasympathetic division results in holding down heart action to a healthy economical rate, in stimulating the activity of the alimentary canal (adequate flow of saliva and other juices of digestion, movements of the walls of the stomach and intestines, processes of elimination of waste products), and an ample distribution of the blood to the internal organs. Such a condition of the body is associated with pleasant, comfortable, quiescent, peaceful, and contented feelings and emotions. It includes the kind of feelings one has when all bills are paid and there is a little left over for pleasures to come, or when one has achieved satisfactorily and there is nothing to worry about. That there may be many varieties of these comfortable states must be obvious, but they all have these same general characteristics of comfortableness and quiescence.

[1] Many authorities present three divisions, the cranial, the sympathetic and the sacral. But as the functions of the cranial and the sacral are associated and are both inhibited by the activity of the sympathetic division it seems wiser here to present the autonomic as composed of two divisions.

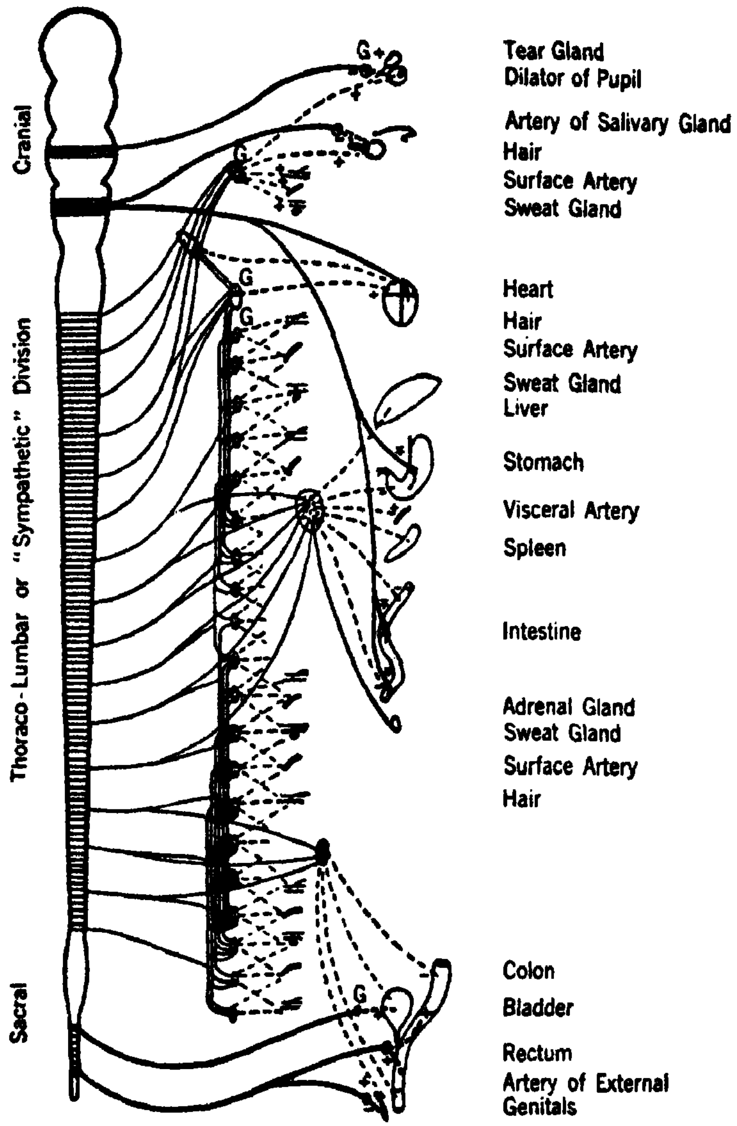

FIG. 5. Diagrammatic representation of autonomic nervous system. Note three divisions and their opposing functions indicated by + and — signs. (From W. B. Cannon, *Bodily Changes in Pain, Hunger, Fear and Rage.* Reproduced by permission of D. Appleton-Century Company, Publishers.)

The effects of activation of the sympathetic division are quite different. By and large the effects of this division are the exact opposite of the physiological and psychological effects of activation of the parasympathetic division. Of effects noted there are increased heart action, shortened breathing, checking of the activities of the alimentary canal (dryness of the mouth, decreased flow of juices of digestion, partial or complete cessation of the muscular activity of the walls of the stomach and intestines), larger distribution of the blood to the periphery of the body (arms and legs especially), reduced activity of processes of elimination (with a few exceptions not well understood), increase in the sugar content of the blood and such changes in the chemical content of the blood as will make it coagulate more readily, change in the electrical conductivity through the skin, and some change more vague which results in the cancellation of the feelings of fatigue. These changes, it should be observed, prepare the body as a whole for violent activity. The blood is prepared to stop bleeding should wounds occur; is supplied with an increased amount of sugar (fuel for the body fires); and is distributed in increased quantities to the great muscles of the body and limbs. The internal activities are temporarily stopped, and the individual provided with a false feeling of power through the cancellation of fatigue sensations. These are the physical conditions which accompany intense fear, great pain, and anger or rage. In all of these emotional states man as an animal is prepared for the activities of defense or escape. That the conventions of culture often prevent the violence of attack or escape and leave the body prepared but unsatisfied creates one very serious problem in the adaptation of the human organism to the ways of modern man. Here one may find the explanation of the relief achieved by some men who when very angry actually saw wood or do some other intense physical activity as a means of working off this preparation of the body for action. The emotions associated with the activity of the sympathetic divi-

sion are often wisely referred to as the emergency emotions.[2]

Instances in everyday life of the appearance of these physiological factors in feelings and emotions are easily discovered. The inexperienced platform speaker is likely to have a touch of stage-fright, which as we now know checks the activities of the alimentary canal, and we see him in consequence suffering dryness of the throat. The trained and experienced speaker would never think of losing the attention of his audience by stopping to drink, and for him it is not necessary because his salivary glands are working freely. Sometimes when traveling it becomes necessary to patronize an unattractive restaurant or lunch counter. When doing so one is likely to discover that his disgust serves quite as well as the meal to check the appetite or the desire to eat. The disgust checks the activity of the alimentary canal and along with it the desire for food.

The effects of these emergency emotions upon sleep present other good examples of such emotional disturbance. A spell of anger prevents one from going to sleep readily. Likewise, fear will prevent sleep. If one is frightened in the night by sounds, as of a burglar, or the smell of smoke which might rise within the house, it is difficult to get to sleep again. The sleep reaction is associated with comfortableness and quiescence of body, that very pattern of functions which is associated with the parasympathetic division of the autonomic system. When this is checked or overruled by the

[2] Early in the history of modern psychology (1884) a famous American psychologist, William James, and a Danish physiologist, Karl Lange, proposed the theory that an emotion was the effect upon consciousness of the physical effects following the perception of an emotion-arousing situation. This became known as the James-Lange theory and appears prominently in most presentations of the psychology of emotion. That theory was, however, proposed at a time when psychological thinking was very different from what it is today and when there was almost no systematic knowledge of the physiology of the emotions. In order to appreciate that theory properly, it is necessary to reconstruct quite thoroughly the amount and limitations of knowledge of that day. Such a reconstruction, or historical excursion, has no proper place here. Consequently it seems better to leave the discussion of the James-Lange theory to some time and place when the reader has opportunity for the additional reading necessary.

activities of the sympathetic division, sleep becomes for the time being impossible. Many functional insomnias have been checked by changing the habits of thought so that the person so troubled retires with a peaceful state of mind; in other words, with the parasympathetic division dominant.

One other physiological item concerning the nature of emotional behavior is of use to the psychologist. This concerns the place and function of the thalami (see Fig. 8, p. 140) in the lower part of the brain, and the physiological patterns associated with the emotions. It appears that centers in these thalami are the points from which excitations go out to produce the many changes in heart action, breathing, muscular tension, distribution of blood, glandular activity and so on involved so importantly in the emotional experience. In the early years of life these thalamic centers are easily aroused and subject to little if any control from any other source. If food is refused, if a pin is stuck into the infant, or if some fear-arousing object appears, the result is the free excitation of the emotion centers in the thalami and the appropriate excitement of the physiological features we know as characteristic of emotion. Emotional control must then be found in terms of some development and organization which will control these emotion centers.

Such control is found through the development of the cortex of the brain and of cortical organization which reaches down and governs the centers for emotion. The well-developed adult manifests a very different sort of emotional reaction from that of the child. His emotions are not so easily aroused and when they are aroused they are seldom aroused to the full. There is a grading effect upon emotional responses. This means that emotional behavior is practically always subject to some degree of control, so that anger, for example, rarely rises to the full or that fear seldom develops into an engulfing terror as otherwise might be the case.

Whatever weakens the organization within or the actual functioning of the cerebral cortex weakens this emotional

control. When cortical control is reduced, then the thalamic centers for emotional response behave again much as they did in childhood. This weakening of control can be observed in persons who are badly fatigued. They are much more irritable and far less able to control themselves. A long illness may produce this condition as well as tiresome labor. Drugs may do the same thing. Any drug which tends to depress cortical functioning will release the cortical control over the lower centers with the consequent emotional behavior which is more childlike. A conspicuous example of this is the effect of alcohol. The person who is mildly intoxicated is notorious for his tendency to be sentimental. He will cry easily, proclaim his affection to all the world, or be as easily aroused to anger, all because of the weakened control.

There are in these facts both hygienic and educational significances. Obviously it is good hygiene to maintain a degree of rest and freedom from drug effects so that emotional control can be maintained. Educationally it must be recognized that the changes from infancy up to maturity include the development of cortical organization and the connections to the thalamus which bring the control needed by the adult. The child has better control than the infant, the youth better control than the child, and the adult normally still better control than the youth. This control is apparently attained by very small degrees. The child learning to take his turn on the playground slide and not to get mad at the others who take their turn ahead of him is acquiring inhibition and control. In learning to play team games and to suppress the desire to show-off as an individual star he is learning to control feelings and emotions. Much of this is doubtless related to the practices of inhibition of those in the environment. The child growing up with a mother who does not seek to control and gives way to temper tantrums is very likely to give way to emotional tendencies likewise. It is

desirable that efforts to control be encouraged and approved. Here is one of the values in discipline.

To a considerable extent, emotional control depends upon the nature of the interpretations accruing in any given individual to any given situation. The person who perceives an eclipse of the sun as something fearsome will experience fear; the person who perceives berries in the woods as harmless will eat them fearlessly, whatever their actual chemical content may be. Changes of interpretation produce changes in the emotional reaction. The victim of a fake hold-up arranged as a practical joke will at first be afraid because he perceives it as genuine. But if in the course of the prank he perceives the voices of friends from behind the masks of the pretending robbers he will change his interpretation and his emotional reaction will change accordingly. Changes of emotional response to a given object or situation may be changed by changing the interpretation which accrues to the perception.

Origin of Likes and Dislikes. How feelings and emotions come into being is a question every psychologist would like to have answered, partly in order to fill a gap in his knowledge but also because if their origin were fully known it might be much more possible to plan educational programs which would develop the kind of emotional responses thought to be the most desirable. But the question is not easy to answer.

Certainly some likes and dislikes are acquired. Every person can recall the experience of learning to like some particular food because it seemed wise to do so for social purposes. And many can recall something which was formerly much liked for which there is little liking now. Certain games are liked for a time and later disliked. Certain popular musical compositions are liked very greatly for a period and then disliked. Thus it seems clear that likes and dislikes may vary from one to the other, and even back again.

But are there any native dislikes and any native likes? It would seem as though there must be.

The infant manifests what looks like the behavior we manifest when we experience pleasantness and unpleasantness. Infants very early respond in a rejecting manner when given a bitter solution and in a manner which we call pleasantness when given something sweet.[3] Perhaps the infants earliest reactions are merely excitement, but the differences between accepting and rejecting responses appear very early. These seem to be examples of pleasantness and unpleasantness. How many such native likes and dislikes would appear if there were no environmental influence we do not know because experience in this world quickly influences the course of establishment of what the individual child will like or dislike.

Origin of Emotions. The beginnings of emotional life in the infant are closely tied up with the beginnings of the simpler processes of liking and disliking just discussed. But emotion is commonly thought of as more complicated than the simple like and dislike. Some years ago there was a careful effort made to discover what were the primitive emotions. This was done by John B. Watson [4] and his associates and it indicated that probably the first emotions to appear were fear, anger or rage, and affection. For a long time these were accepted as the beginnings of emotion, as the primitive forms. Out of these all other emotional experience was supposed to be developed by conditioning and modification in one direction or another. Then it was demonstrated [5] that adults are quite incapable of judging emotion in infants. Consequently we are not at all sure that the persons who participated in those famous studies of Watson were able to report

[3] Pratt, K. C., Nelson, A. K., and Sun, K. H., *The Behavior of the Newborn Infant*, Columbus, Ohio State University Press, 1930.

[4] Watson, J. B., and R. R., "Studies in Infant Behavior," *Scientific Monthly*, 1921, 13, 493-515.

[5] Sherman, M., *Process of Human Behavior*, New York, Norton, 1929.

accurately the emotions which the babies they studied actually experienced.

It is the tendency now to think that emotions begin as a vague general excitement within the baby which might be termed excitement or emotion but which could not be described as any particular form of emotion. The special forms of emotion develop later as a consequence of training and the development of such perceptions as have an effect upon emotional behavior. Perhaps there is an intrinsic tendency toward the development of certain emotional patterns but even that is quickly influenced by experience. The first form of reaction of an emotional nature might be described as excitement. Then comes what might be termed a pleasurable sort of excitement or delight and an unpleasurable sort of excitement or distress. The first of these will later be progressively differentiated into elation and joy and affection. The latter will subsequently be differentiated into anger and disgust and fear.[6]

All of this comes of course very early in the life of the infant. By the time of entering school the general forms of emotion must be very well established. After that it is a matter of what shall be feared and what shall not, what shall arouse anger and what shall not, and so on. It is a matter of training in perceptions. And this is important. What a man hates and fights against and what a man loves and fights for lies behind most of contemporary social problems.

Emotion as a Disturber. Emotion is often described as a stirred-up state of the organism and to a certain extent this is true. It is true of certain emotions and it is also true that such a stirred-up condition is not the best condition for regu-

[6] Bridges, K. M. B., "Emotional Development in Early Infancy," *Child Development*, 1932, 3, 324-341.

Goodenough, F. L., "The Expression of Emotions in Infancy," *Child Development*, 1931, 2, 96-101.

Blatz, W. E., and Millichamp, D. A., *The Development of Emotion in the Infant*, Univ. of Toronto studies: Child development series, no. 4, 1935.

Sherman, M., "The Differentiation of Emotional Responses in Infants," *Journal of Comparative Psychology*, 1927, 7, 265-268, 335-351; 1928, 8, 385-394.

lar work nor for thoughtful adjustive response. When one is frightened, it is impossible to settle down quietly to regular work; nor is one able to settle down to regular work when very angry. The person in such states is so stirred-up that he is unable to think of anything except the matter which has aroused the emotion. And he does not think about that very clearly. Even the best-developed persons are likely to do queer things in a state of great emotion. That they often forget and are prone to impulsive actions is a matter of common observation. Anyone who has been through the experience of stage-fright knows very well the forgetting effect of emergency emotion. Persons who are very anxious for the welfare of a relative seriously ill often walk the floor in profound agitation unable to do anything worth while and likewise unable to remain quiet. It should be recalled here that the physiological changes in the body in such an emotion prepare the body for great physical activity and not for quietude.

It is probable also that the disagreeable emotions interfere with the setting process from any impression. There is some truth in the statement that we tend to forget the disagreeable. On this there has been much experimental work, not always with the same conclusions; but the trend of the results indicate that probably we do not recall the disagreeable quite as well as the agreeable. Nevertheless, as everyone knows, there are many experiences in life of a highly disagreeable nature which we would like to forget, would be glad to forget, but are unable to do so. The experimental studies have usually been made with things and experiences which are but mildly disagreeable and not the very disagreeable experiences of everyday life. With the latter the results might be to some extent different. We may tend to forget the disagreeable unless the emotion is too intense; then it may be difficult to forget.

Emotion as Aid. In the above presentation the emphasis was upon those emotions which are associated with the sym-

pathetic division of the autonomic system and associated functions. Here we are concerned with the emotional states, of a milder nature and less disturbing, which are associated with the parasympathetic division of the autonomic system. The quiet, comfortable, joyful states are conducive to regular work. When a person is feeling contented and happy, he is able to apply himself regularly to the work before him. There is nothing to distract the attention and everything to make regular work attractive. This is true within certain limits only, however; but if the agreeable state becomes too intense then again the emotion becomes a disturber. If one is highly joyous over a victory, or some great opportunity which has come, there is no likelihood of one settling down in such a state to regular work. One is in such a state too excited, although it may be agreeable excitement.

As was mentioned above the effect of agreeable states upon memory is favorable. That which is experienced agreeably has a somewhat better possibility of subsequent recall. The experimental studies here have been numerous and generally with about the same results, although the balance in favor is not very great.[7]

Distorted Emotional Reactions. Many instances may be observed in which the emotional reaction to a situation is either far too intense or quite inappropriate. This pertains especially to fear. Persons will occasionally be met who have a fear of snakes out of all proportion to the actual danger. Some have such a fear of being in a closed place; others have a comparable fear of open places, such as the prospect of crossing an open street. These are known as phobias. And then, too, there are many instances of special objects which ordinarily do not arouse fear at all which in certain individuals stir a morbidly intense fear. One has a morbid fear

[7] Barrett, D. M., "Memory in Relation to Hedonic Tone," *Archives of Psychology*, 1938, no. 223. (This contains also a good summary of the literature and a good bibliography.)

of railroad trains; another of knives; another of the prospect of crossing any bridge no matter how large and secure.

Sometimes it is anger which gets out of control and reacts too intensely. In such cases one may see a person fly into a rage over some little thing which would not ordinarily cause a person anything more than a little irritation or perhaps would not in most people cause even that. Sometimes these rages are expressed in a peculiarly futile manner of pounding the floor and screaming. Then they are popularly referred to as tantrums.

All this seems very childish and there is probably in all of this some hang-over of childish ways of responding. Some of these morbid fears are doubtless the retention into maturity of childish reactions; although the adult so afflicted may not be able to recall the childhood experience which started them. In the anger or tantrum cases there seems to be more certainly the retention into maturity of childish responses. As a child the person may have been able to get what he wanted by the tantrum: and now as an adult, even though he may be ashamed of it, the same reaction takes place whenever desires are thwarted. The normal development of the cortex into a controlling organization does not function in these cases. Probably there is much the ordinary sort of cortical development but this particular form of response has been allowed to continue quite apart, or almost apart, from the whole organization. If the effort had been made early and at the proper time, the temper tantrums could doubtless have been checked as they are in most normal persons. So also with the morbid fears. The morbid fear of being left in a room with a door closed, the fear of closed places mentioned above, may date back to being placed alone in the dark in a locked closet perhaps as a punishment for some wrong doing. It may date back to something worse than that even. Instances are known of children actually being caught in a cave or other dark place unable to escape by themselves and this experience leaving behind a life long

morbid fear of being in a closed place. Careful training at the time so that a full understanding of the situation be achieved, and an ample effort made to develop confidence when in a dark and closed place by working up to it little by little, would probably prevent the life long phobia. But such things are usually not done. If a person has as a child such frightening experiences the usual treatment is to avoid all thought or mention of the thing for as long as possible. Thus much organization is allowed to take place and the fear reaction to closed places is allowed to stand isolated and ready for re-arousal whenever the proper circumstances occur.

Sometimes, rather often in fact, the person who has the phobia has no knowledge of its origin. The circumstances of the first fear are now completely forgotten. But there must have been a first time and the impressions made by that first time are obviously still effective. There is thus something between the perception of the object or the situation and the reaction which stimulates this fear. The same may be true of the abnormal anger in the temper tantrum, although in such cases there is a greater likelihood that it is a simple reaction of a childish type taking place apart from the general personality organization. When the fear is so determined by the remnants of some forgotten experience these remnants are known as a complex. When the fear occurs in response to the presence of something which would ordinarily never arouse fear, then it is much easier to see that there must be apart from consciousness something, the remnants of some forgotten experience probably, which is stimulating the inappropriate fear reaction. If the nature of that complex were known it might be possible to recall it all and re-educate the person much as should have been done when the trouble first arose.

The Association Reaction Test. One of the methods used by clinical psychologists to discover the nature of the forgotten experiences which built the complex producing the morbid fear reaction is known as the association reaction

test. It is built on the principle that whatever stirs emotion disturbs the course of thinking. That this principle is ordinarily true anyone can observe for himself. The stoppage of thought by stage-fright almost everyone will recall; and the disturbance of thought and action by emotional excitement can occasionally be seen by most readers. Thus, if a person is stimulated by the sound of a word which touches the complex, some emotion will be aroused and the response slightly disturbed. This may happen although the person subjected to the test may merely perceive the word as anyone else would.

The association reaction test is a long list of words,[8] usually about a hundred, so selected that they will touch on as many different aspects and experiences of life as possible. Then these are presented one by one, by the experimenter pronouncing each carefully to the subject. The subject is instructed to respond by speaking the first word which comes to mind. The experimenter using a stop-watch makes a record of the response word given and of the length of time in seconds elapsing between the stimulus word and the word given in response. Thus if there is an emotional disturbance aroused by certain words they may be isolated from the rest and examined to discover if they give any hint of the nature of the forgotten material causing the emotional reaction.

The discovery of those words which indicate emotional arousal has become a very complicated task. The mere length of time of the reaction is far from being the only possible indication of emotional arousal. Sometimes it is the response word itself which indicates emotion. If the response is a very peculiar one, that is noted. If the stimulus word is repeated, if some quite irrelevant word as when the subject looks about the room and gives in response the name of some object present, if the word is apparently misunderstood, although it had been clearly pronounced, or if the response is accompanied by obvious signs of emotion, then the conclu-

[8] See Conklin, Edmund S., *Principles of Abnormal Psychology*, chap. XVIII.

sion is that in such cases there has been disturbance by emotion. All such words are brought together and examined carefully to discover if possible some clue to the probable nature of the lost experience which caused the distorted emotional reaction. Examination of these by the subject himself may help to bring to mind the forgotten memory trace. Frequently such methods work very well; but quite as frequently they fail. Success or failure may depend upon the skill of the operator, the actual words used as stimuli, and perhaps somewhat upon the nature and age of the person so studied.

Tests for Guilty Knowledge. Much has been made in recent years of the so-called "lying machine." This is merely the application to the study of criminal cases of what has been presented above as the effects of emotion upon human responses. When the feeling of guilt is aroused then there should be with it the phenomena of the physiological and behavior changes of an emotion. Sometimes the association reaction method described above has been used. But where so used there is added to the general list of words a number of words which are known to be associated with the crime committed. If the subject of the experiment is guilty, then, when such words appear in the list, they should stir a little emotion and have some one of the recognized emotional effects upon the response. The reaction time for example should average much longer for those words which have been added because they are associated with the crime than is the average reaction time for those other words which are insignificant. If the same test were tried on a person who is entirely innocent and knew nothing more about the crime than any ordinary citizen, all of the words should produce about the same sort of reaction.[9]

This method is now rarely used because in most instances

[9] Crosland, H. R., *The Psychological Methods of Word-Association and Reaction-Time as Tests of Deception*, University of Oregon Publications, Psychological Series, 1929, 1.

it is extremely difficult, if not impossible, to find words for the significant list which are significant to the person who committed the crime and to him only. If an innocent person knows all about the crime and is fearful of being wrongfully accused, he is likely to respond with emotion to the significant words and thus appear to be guilty when he is not. In school cases of stealing this is usually true. The theft is talked over and discussed by many before any serious attempt is made to discover the culprit. By that time too many people know the details to make possible the use of the association reaction test with any certainty of success.

The "lie detector" as it is called by the public is ordinarily one of several methods for detecting emotional reaction by automatically recording the physical accompaniments of the emotion aroused. It is thus somewhat more delicate and for that reason usually more successful than the association reaction method. As has been pointed out above, in an emotional response there is change of heart action, change of respiration and change of electrical skin resistance. It is these which are customarily used by the "lie detector" techniques. Apparatus is made available to record one or more of these changes.[10] Then the person is asked a number of questions which may be answered indifferently, such as name, place of birth, and so on. After a few such questions a specific question is asked concerning the commission of the crime. If the subject is guilty and tells a lie, characteristic changes are expected to appear in the records of heart action, respiration or skin resistance, or of all three. With this technique, remarkable success has been achieved. Its results are not admitted as evidence in court, but they frequently help greatly in the discovery of the guilty person, and often when confronted by the facts discovered the culprit will confess.

Complex Emotions, Derived Emotions, Sentiments. Previously this presentation has been concerned with some very

[10] When more than one of these is used a multiple pen-recording device is necessary, hence the term "polygraph."

simple and primitive forms of emotion. But in addition to the simple forms of fear and anger and disgust there are in adult life many other forms of emotion which deserve some consideration. Many can be named. We know of many esthetic feelings, of moral feelings, of the feeling of belonging to a group or society, resentment, disdain, ecstasy, humorous feelings, doubt, melancholy and altruistic feelings. These are but a few of the many which are commonly spoken of. The course of their development is not well mapped out but that they are derived by modification from simpler emotions is generally believed. In the course of the educational process of childhood and youth the experiences of life gradually modify and combine emotional reactions until these many forms are possible. That they are closely related to the nature of the situations involved is obvious. They cannot be divorced from their specific situations. Perception and thought have gradually changed a reaction pattern, or resulted in the combination of parts of two or more. It is these which are known as complex or derived emotions.

That such emotions play a very important part in life everyone can recognize, but of their development and control not so much is known. The feelings in response to the various works of art are known and usually enjoyed. To the beauty of the sunset and the moonlight landscape most human beings respond with feeling, but the feeling is not of the primitive form of fear or anger or affection. Something has taken place in the course of development to bring about new forms of reaction. The feeling response to music in all its forms, to the graphic arts, to the plastic arts, adds much to the enjoyment of life. The development of all of these is now recognized as important. That they depend largely upon perception and the development of perception is known and this fact is to some extent utilized in education.

Some of the very common forms of emotional experience have not yet been mentioned. All of the different forms of love have been omitted and so have the hates of life. These

can probably be best treated as sentiments, because they really involve a number of other emotions. McDougall [11] is responsible for this concept. According to his thought love is not in itself an emotion but the possibility of many different emotions being aroused by a single object, the loved object. Within the cortex and reaching down to the emotional levels in the thalamus there are established the connections already discussed. It is in this organization McDougall believes will be found the sentiment patterns. Thus *a sentiment* is never a conscious experience. It is *merely a name for a certain kind of nervous pattern.* A loved object has aroused in the lover many different emotions. Gradually a sentiment is established between the perception of the loved object and the various emotional patterns. Love is thus thought of as achieved by a gradual development. Loves differ in the nature of the sentiment and the pattern of emotions aroused. The love of a man for a girl would thus be different from the love of a man for his dog. Likewise all the other kinds of love which could be mentioned differ in the pattern of emotions they arouse.

Hate is also thought of as a sentiment. As consequence of irritating and annoying experiences with some person or object a sentiment becomes established which tends to arouse a very different pattern of emotions from that aroused by the love sentiment. Some of these emotions may be the same, however, for an emotion may according to this theory be aroused by two or more sentiments. There may be many different kinds of hate sentiment as there are different kinds of love.

Acquired Emotional Reactions. Many of our emotional experiences can best be thought of as acquired responses. Many of our fears are of that variety. The child may be afraid of a loud noise and never think of any fear in connection with a snake. It may never have seen a snake. Then one day while in the yard its attention is attracted by a pretty

[11] McDougall, Wm., *Social Psychology*, chap. 5.

snake wiggling along through the grass. Just at that moment the mother also sees the snake and screams. The scream arouses fear in the child at the same time as it sees the snake. The result may be an acquired response (similar to conditioned learning) so that subsequently the sight of the snake stirs the fear reaction. Very likely many other emotional responses of life have been established by such means.

Other examples of it may be found in the experience of most persons. The love of home is probably in large part the linking of comfortable reactions to the presence of the family, the old house, the fireplace, and so on. Some persons come to feel that they are never quite so comfortable as when smoking their old familiar pipe. This too can be explained in terms of learning or acquisition. Their comfortable experiences have taken place so often in association with the presence and taste of the pipe they become thoroughly linked together.

It is interesting to observe further that many disagreeable emotions are aroused by the absence of the familiar stimuli to which comfortable responses have been associated. The absence of the familiar fireplace, the absence of the familiar pipe, or the absence of familiar voices, may leave the person in a very uncomfortable state. Sometimes this is termed homesickness. The constant presence of unfamiliar stimuli results in most persons becoming uncomfortable. Special attention seems necessary, special efforts to adjust seem to be called for, the person feels that he can never rely upon his habits alone, and probably that latter thought is true. He could rest comfortably, he could work comfortably, if he were in an environment such that his habits would be sufficient. Without them he is uncomfortable and unhappy. Gradually he may become accustomed to the new and then that in turn comes to be the old familiar which makes him comfortable. This illustrates very well to what a great extent our emotional reactions are dependent upon the cognitive or purely intellectual experiences of life.

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Chapter VI

SENSORY SOURCES OF KNOWLEDGE

The amount of knowledge to which any person may aspire is limited not only by the degree of his ability to comprehend and to think but also by the opportunities which he may have for learning. And by opportunities for learning it should be observed that reference is made not only to the opportunities for schooling and for reading but also to the opportunities made available by nature for coming into responsive contact with the world about. Vision, for example, makes it possible for a human being to learn much about the world around him that could never by any possibility be achieved without the use of eyes. One who was born blind may, it is true, achieve a considerable degree of education, of knowledge of this world, but it has to be done through the active use of other sensory apparatus and even then there are obvious limitations beyond which the person born blind cannot go. By no utilization of the other sensory approaches is it ever possible for the born-blind to know what the experience of color is like. The person born deaf can never know the strains of an orchestra in the usual manner, the call of the birds, nor the variety of human voices and the sounds of different languages. Likewise the absence or defective nature of the sensory apparatus for smell or taste or touch leaves the one so defectively endowed forever limited in the possibilities of experience, hence limited in the possibilities of knowledge.

Our senses are thus our sources of knowledge concerning the external world. They also serve as the means of contact with the outside world for the purpose of responding effec-

tively to it. One may have a wealth of knowledge, of possibilities of response, but unless there are sensory contacts the wealth of knowledge or possibilities of response may lie idle or appear only at inappropriate times and places. To be effective, knowledge must be associated with sensory activity so that when the world about us stimulates a sense organ, the proper response will be set off by that sensory activity. So, to the sight of an oncoming automobile we stop and judge distance, speed, and the situation as a whole. But without sight the responses of stopping and judging might not function at the proper time.

The development of knowledge can wisely be thought of as the development of effective responses associated with sensory activity. The child must learn to stop and to go and to come when certain peculiar sounds are made within its hearing. Likewise the person of much learning is the person who can make the correct responses when stimulated by the sight or sound of words which produce no effective response in the child or the unlearned. The person who knows much about chemistry is one who has available the appropriate responses when confronted by certain peculiar patterns of symbols, of peculiar combinations of test tubes, heating devices and the like, of odors and tastes and cutaneous sensory experiences. The person who knows how to cook is the one who responds in a way which results in edible food when his sensory apparatus is activated by the presence of food substances, heating apparatus, cooking utensils, and so on. A physician is one who responds effectively when his eyes are stimulated by certain patterns of facial expression in the patient, of certain patterns of pressure when his finger is placed upon an artery, of certain weak sounds when his ear is brought into contact with the region of the lungs and the heart. Knowledge is thus dependent upon the possession of healthy sensory apparatus, upon its proper stimulation, and upon having the responses possible properly linked to these different kinds of sensory activity.

As this is not a textbook about chemistry or cooking or medical practice knowledge concerning those subjects will not be presented. That can all be achieved if the reader has the proper sensory apparatus and a sufficient degree of ability. What is here of importance is the achievement of a knowledge of the sensory apparatus and especially of its functioning. What are the kinds of possible sensory contact with the outside world? What kinds of experiences are produced by these sensory contacts? What are the limitations of each? How do different kinds of external situations, different kinds of stimulating substances or stimulating situations affect them? These are questions of importance for the student of human nature to answer if he would understand the means for the achievement of knowledge concerning the world about.

Cutaneous Sources. Through the skin covering of the body the new-born infant comes into immediate contact with this world, and in the years that follow contacts through the surface of the body continue to be a prolific source of information. To be sure of things, to be sure of much of our knowledge, most of us want to get things where we can "lay our hands on them." We somehow have a peculiar confidence in the cutaneous sensory experiences as sources of knowledge. Careful examination reveals, however, that the skin is not one great sense organ spread over the body, but is the means of several different kinds of sensory contacts or sensory experiences. Through the surface of the body we have sensory experiences of temperature differences and changes (warm and cold), of pressure or contact, and of pain.

More remarkable still is the now long-established fact that each of these four different kinds of cutaneous experience do not come from the skin surface in general, all arousable in any one and the same spot, but that each comes from its own spots or points on the body surface. It is as though the skin were a great mosaic of sensory points or spots. This has been discovered by what is known as punctiform explora-

tion. Experimental efforts to stimulate cold sensations under carefully controlled circumstances led to the stimulation of one spot and now another with a cooled metal stylus and the revelation that frequently the application of the cold stimulus to the skin produces no sensation of cold at all. Likewise stimulation with a stylus warmed considerably above skin temperature will produce sensations of warmth from certain spots only. The same is true of sensations of pressure or contact, and also of pain. These spots for each of the four qualities have been very carefully studied and it is also established that their frequencies on the body surface differ. There are far more pain spots on the average than of any one of the other three. While the average frequency of these is about 175 per square centimeter of skin surface [1] there are large variations from this average. There are some small areas which have no pain spots, are thus insensitive to pain. One of these may be found on the inside of each cheek. Other areas have well over 200 per square centimeter.

Pressure spots are not quite so frequent, ranging from as low as six or eight per square centimeter (lower leg and upper arm surface) to such areas as the tips of the fingers and the lips where they are very frequent, as high as 100 or more per square centimeter. The average is probably around 25. Cold spots are still less frequent, averaging about seven per square centimeter; while spots producing warmth sensations are surprisingly infrequent, averaging considerably less in frequency than cold spots when located by a continuously moving stimulus. Other methods of study produce results pointing to a higher frequency, perhaps about like the average for cold spots.

It will be observed at once, however, that this method of studying the skin senses by the application of a pointed stimulus to now one spot and now another is a very artificial procedure. The skin is not ordinarily so stimulated in everyday life. The more common form of stimulation might be

[1] Boring, E. G., Langfeld, H. S., and Weld, H. P., *Psychology*, p. 163.

called areal. Objects and larger surfaces come into contact with the body. These spots are near enough together so that any ordinary areal stimulation will contact some of each and if the stimulus is of the appropriate kind will arouse several at once. It is not even necessary for a cutaneous stimulus to come into actual contact with the spots mentioned. Take the pressure spots for example. A pointed instrument pushed against the skin will pull the surface tissues in such a manner as to affect pressure spots at some considerable distance from the point of contact. Temperature stimuli will so affect the skin as to arouse temperature spots adjacent to the place at which the stimulus is applied.

One curious fact about these temperature spots is that they can be aroused in a reverse manner. Very cold stimuli applied to a warm spot will result in a warm sensation; very warm stimuli applied to a cold spot will produce a cold sensation. These experiences are termed respectively "paradoxical warmth" and "paradoxical cold." The latter is very easily demonstrated, but the former can be produced only with considerable difficulty. For a long time it was supposed that the paradoxical warmth was impossible of production.[2]

Cutaneous Fusions. But every reader is almost certain to think before this that there are many other kinds of experience obtained by skin contacts than the four so far discussed. There are the experiences of hotness, wetness, oiliness, hardness, softness, and so on. These are known technically as cutaneous fusions, because they are produced by combinations or fusions of sensory experience. Hotness is a good example. This quality of sensory experience never appears in punctiform exploration of the skin. By such means sensations of warmth only are obtainable. An areal stimulus, like the head of a big nail for example, warmed to a temperature considerably above that of the skin will when applied

[2] In spite of many assertions to the contrary paradoxical warmth appears to have been demonstrated as long ago as 1884 and then forgotten. See Pavlicek, J., and Jenkins, J. G., "Paradoxical Warmth," *American Journal of Psychology*, 1933, 45, 350-353.

to the skin produce a sensation quite different from that of warmth. This is known as hotness. It is produced by the simultaneous stimulation of warmth and of the paradoxical cold. The fusion of these produces the quality we know as hotness. Putting the hand into hot water will produce this over a comparatively large area. If the water is too hot it will also stimulate pain and then the hotness has a peculiarly stinging quality. The truth of this analysis has been experimentally verified by simultaneously stimulating both warmth and cold spots by warm and cold stimuli. The result is then the illusion of hotness.[3]

The other cutaneous fusions are comparable. Wetness is produced by combinations of temperature and pressure. Oiliness is a combination of light pressure and of warmth. *Hardness and softness are patterns of pressure but are com*bined with sensations from the muscles and perhaps sometimes from the joints.

Cutaneous Adaptation. One very important feature of cutaneous sensitivity is the possibility of what is known as adaptation. This is a common phenomenon of everyday life. The new pattern of pressures produced by a new article of clothing may be at first so unique that we are constantly aware of it but after a while we no longer notice the new clothing. We have become adapted to this pattern of pressures. We go into a warm room and at first are keenly aware of the warmth but after a little no longer notice the temperature. We dive into cool water and at first note the coolness but after swimming for a while the water no longer appears to be cool. A simple but impressive illustration of this is to plunge the hands simultaneously into warm and cold water. For one hand the water should be as warm as can be easily borne. For the other it should be very cold. When the

[3] This long-accepted interpretation is now being seriously questioned: See Heiser, F., "Stimulation of Cutaneous Sensations of Heat," *Psychological Bulletin*, 1938, 35, 717, and Jenkins, W. L., "Does the Alrutz Theory of 'Heat' Apply to the Common Experience of 'Hot'?", *Psychological Bulletin*, 1938, 35, 717.

hands have become adapted individually to their temperature stimuli, one to very warm and one to very cold, they should both be plunged simultaneously into the same bowl of lukewarm water. Then will the lukewarm water appear in the cold-adapted hand to be very hot and in the warm-adapted hand very cold. Adaptation to pain is more difficult of achievement. Some have reported that it was impossible. A difficulty apparently lies in the achievement of constant pain stimulation. When that is achieved, there does seem to be adaptation; but constant pain does not ordinarily occur and so ordinarily we do not experience adaptation to pain.

Other Qualities in Cutaneous Experience. Attention is often called to the existence of yet other cutaneous experiences described in everyday life as tickle and itch and prick. *These are apparently due to very mild stimulation of pressure and pain spots.* A very light stimulation of pressure spots produces the tickle quality and light stimulation of pain spots produces the itchy experience. A little stronger stimulation of pain spots, but not enough to produce the pain sensation is what is necessary to produce the experience of prick. Why body areas differ in the ease of producing tickle is a question not easy to answer. Some think that the areas in which tickle is more easily produced are the more vulnerable areas of the body and that it therefore has a protective value. But this is a theory not always easy to support and as a consequence other, and sometimes fantastic, explanations have been offered. A very definite answer is not yet possible.

Neural Accompaniments. Many have wanted to know just what was the nature of the nerve structures in the skin which were aroused by cutaneous stimulation. It is quite logical to assume that as the eye is responsive to light and the ear to sound so there must be some sort of special form of nerve ending in each of the cutaneous sensory spots. It has been demonstrated that there are in the skin in addition to free nerve endings (nerve endings with no special

sensory structure on them) a number of forms of special nerve-ending structures[4] but the exact relation of some of these to the qualities of sensation experienced is not yet clear. The nerve endings around the hair in the hair follicle without doubt mediate the sensations of pressure where there is hair on the body. The free nerve endings appear to be the means of producing pain. But the structures for warmth and cold are still a problem. In one study, very carefully made, the warm and cold spots were located and then the area of the skin studied was excised and mounted for microscopic examination, but not a single specialized end-organ could be found.[5]

From the surface of the skin the sensory excitations aroused are carried to the inside of the spinal cord over the sensory nerves. These are to be thought of as bundles of isolated neurone processes. Each sensory neurone like all other neurones is composed of a cell body and the processes which have grown out from it. But the sensory neurone is peculiar in its apparent limitation to two such processes. One of these has grown out all the way to the skin while the other goes from the cell to the inside of the spinal cord. The cells of the sensory neurones lie outside of the cord in an enlargement on the nerve trunk just before it enters the cord.

It is important thus to observe that there is no chain of neurones involved in carrying an excitation from the skin to the inside of the cord. There is only a bundle of neurones lying parallel to each other, of which one or more (probably more) is aroused by the stimulus. After an excitation has reached the inside of the cord there appears to be a separation according to the nature of the sensation to be aroused. Other neurones there take up the excitation and

[4] For good drawings of these see Herrick, C. J., *Introduction to Neurology* (5th ed.), pp. 85-91.

[5] Dallenbach, K. M., "The Temperature Spots and End-Organs," *American Journal of Psychology*, 1927, 39, 402-427. See also Nafe, J. P., and Wagoner, K. S., "The Experiences of Warmth, Cold and Heat," *Journal of Psychology*, 1936, 2, 421-477.

carry it on up to the brain but the paths of these other neurones appear not to be alike for each of the cutaneous sensory qualities. Warmth, cold and pain excitations appear to be transferred to a tract on the outer or lateral portion

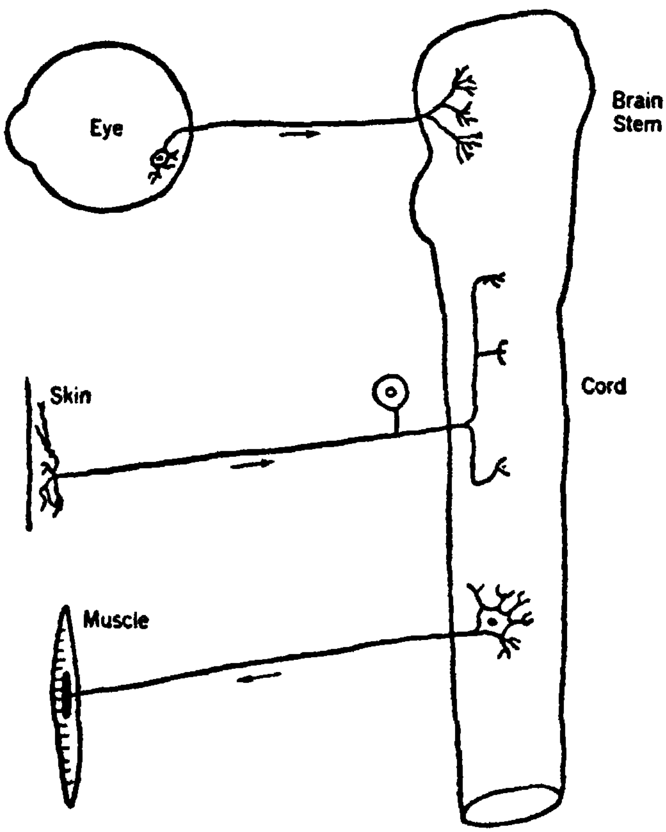

FIG. 6. Diagram of cord with sensory and motor nerves. (From Robert S. Woodworth, *Psychology*, Third Edition. Henry Holt and Company, Inc.)

of the other side of the cord and in that pass up to the brain, but excitations for a pressure experience go to a tract in the front or ventral part of the cord and thence up to the brain. Hence if there were damage to one of these tracts there would be a loss of only those sensory qualities carried by it. The others would remain uninjured.[6] These sensory

[6] See Herrick, C. J., *Introduction to Neurology* (2nd ed.), pp. 149-153, 189-192.

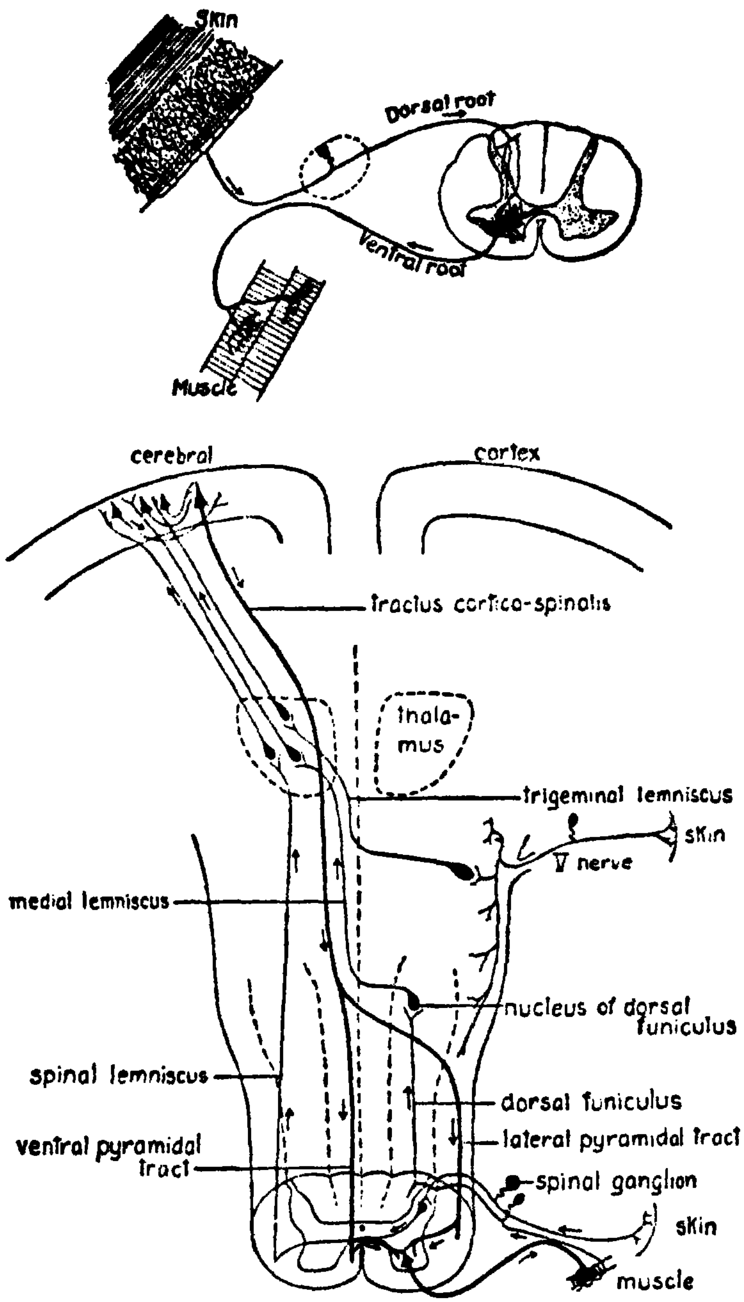

FIG. 7. The upper part is a diagram of a reflex arc. The lower part represents tracts through cord and brain. (From Herrick's *Introduction to Neurology*. Reproduced by permission of W. B. Saunders Company, Publishers.)

tracts for cutaneous sensations carry their excitations up to the thalamus where again there is a junction point or way station. Here other neurones take up the excitation and carry it up to the cortex of the brain. These find their endings in what is known as the post-central gyrus or convolution. From there any one of a vast number of connections is possible, according to the many different responses we see in everyday life to cutaneous stimulation.

Kinesthetic Sources. These constitute a prolific source of knowledge, although not always in as explicit detail as some of the other sensory sources. The term "kinesthetic," meaning sensation of movement, is used to designate the sensory activity aroused by movements of the muscles, the tendons and the joints of the body. Obviously where there is so much movement there must be a vast amount of such sensory activity. Very much of it, however, never produces the detailed kind of response we call awareness. Much of it is in the background, although none the less important to the business of everyday life. In walking, the movements and the balance of the body are continued and maintained through the setting off of proper responses to sensory excitations coming in from the muscles and tendons and joints. In trying to learn some new stunt, the throwing of a curved ball or some new stroke in tennis or golf for example, we frequently find ourselves trying the thing rather blindly until we "get the feel" of it, as we say. The activities of life mean far more to us if we have done the things for ourselves. Probably this is the real justification for much of the laboratory work in our schools and for the activities provided for the education of children. Seeing the teacher demonstrate how things are done is far from being as satisfactory as the experience of doing the thing for oneself. Self-activity brings into the experience importantly the excitations coming from the kinesthetic sensory apparatus.

The absence of the kinesthetic activity in any part of the body produces defects of behavior which are as curious as

they are instructive. Without the kinesthetic processes a person will not know where his arm is for example. If blindfolded and told to put the other arm in the same position as the one in which there is a kinesthetic defect, he is unable to do so. If told, while blindfolded, to grasp some object and report on its nature, he may not be able to do so until he shifts it into the hand where the kinesthetic apparatus is functioning normally. *Adaptation* in the kinesthetic field, although not a very frequent experience, does occasionally occur. Its effect is much like that of the absence of the sense except that it is ordinarily of very short duration. Upon awaking from a very quiet sleep there is sometimes the experience of not knowing where an arm is until something brings about movement in that arm. This appears to be due to adaptation.

Kinds of Kinesthesis. In the kinesthetic group there are three kinds of sensory experiences. These are known according to the locations of the sensory end-organs. They are the muscular, the tendinous and the joint. When the sensory processes coming from the muscles are artificially isolated the quality experienced is described as that of dull pressure. When it becomes more intense it is described as dull pain and eventually as ache. The sensations from the tendons are more difficult of isolation but are described as strain. At greater intensities these also take on the character of dull pain and of ache. The sensations from the joints are described when isolated as having a quality for which we have no good term but can perhaps be likened to a soft or smooth pressure.

Kinesthetic Neural Apparatus. In the muscles of the body are many endings of sensory nerves. These are found wound around the muscle fibers where movement of the fibers will stimulate them. For the tendinous sensations the end-organs are spread out over the surface of the tendon, mostly near to where the muscle fibers begin. There are many free nerve endings in the joints, but these are ordi-

narily associated with pain. There are also, however, a number of specialized nerve endings, known as Pacinian corpuscles, in the membranes of the joints and it is supposed that these mediate the joint sensations.

The sensory neurones carrying the excitations from the kinesthetic end-organs to the inside of the cord are in appear-

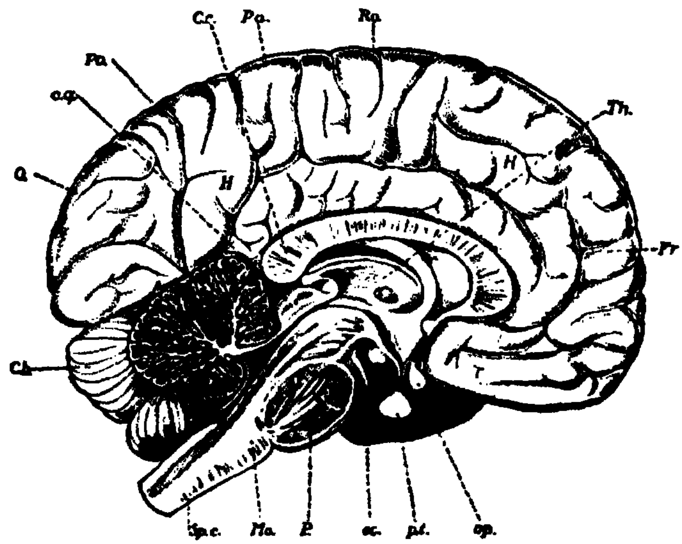

FIG. 8. Diagram of the left half of a vertical median section of the brain (Sobotta-McMurrich, *Atlas and Text-book of Human Anatomy*). H, H, convoluted inner surface of left cerebral hemisphere; C.c., corpus callosum; Th, thalamus; c.q., corpora quadrigemina; Cb, cerebellum; Sp.c, spinal cord; Mo., medulla oblongata; P, pons Varolii; oc, oculo-motor nerve; pt, pituitary body; op, optic nerve; Ro, central sulcus (fissure of Rolando); Po, parieto-occipital fissure; Fr, frontal lobe; Pa, parietal lobe; O, occipital lobe. (From Martin's *The Human Body*, 12th edition.)

ance like those described in connection with the cutaneous sensations. They are typical sensory neurones. Some of these neurones end in the gray matter of the cord near the level of their entry. There the excitation is taken up by other neurones which send their axones into the white matter of the side of the cord and on up to the cerebellum, where the many interconnections are effected which care for the maintenance of body balance. But there are also many of these kinesthetic neurones which assist in carrying an excita-

tion up to the cerebral cortex. These after entering the cord pass into the great bundles of white matter in the back

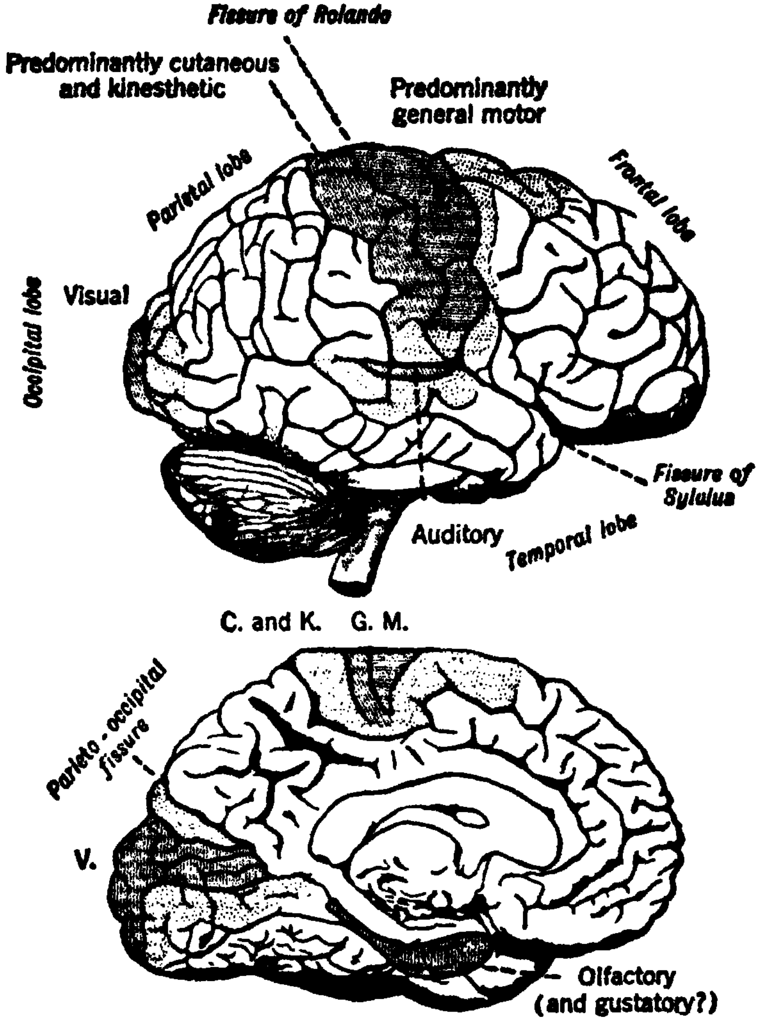

FIG. 9. Diagram of brain. (From J. F. Dashiell, *Fundamentals of General Psychology*, Houghton Mifflin Company, modified from W. B. Pillsbury, *Fundamentals of Psychology*. Reproduced by permission of J. F. Dashiell and The Macmillan Company.)

of the cord, between the roots, and continue there up to centers just inside the medulla. There other neurones take up the excitation and carry it into the thalamus of the other

side of the brain from which yet other neurones carry it on up to the cerebral cortex. In the cerebral cortex they end in the post-central convolution from which the innumerable connections are made that are necessary for the complicated activities mentioned above.

Equilibratory Apparatus. Knowledge of body equilibrium, of movement up and down and in circles, of changes of direction of movement, is a matter of everyday experience and yet it is curiously not classifiable among the other senses as sources of knowledge. For the maintenance of equilibrium we have a very delicate apparatus to be sure, and associated with it an elaborate and effective arrangement of connections with the muscles of the body and of the eyes; and yet, unlike our other sensory sources of knowledge, there are no clearly observable experiences to be directly associated with its functioning.

The sensory apparatus for all this is to be found as a part of what is often referred to as the inner ear. Closely associated with the nerve endings for hearing, the auditory apparatus, there are specialized sensory endings designed to be responsive to movements in the various possible directions. Parts of this are especially well made for response to movements in angular directions and other parts to changes in speed of movement in straight lines. (See illustration under auditory sensation.) The sensory nerve from this carries excitations to a center in the medulla in the floor of the fourth ventricle. From there other neurones carry excitations to centers governing the muscles of the head and limbs of the body, to the eyes, and especially to the cerebellum. But there are no direct connections to the cerebellar cortex. This is probably why we have no direct sensory experiences from this sensory apparatus. We do, however, have ample experience from the various patterns of muscular activity aroused by it and associated with it. We are aware of a loss of balance and of the reflexes aroused to maintain it; we are aware of nausea as a consequence of too much disturbance

of equilibrium; and we know the experience of being dizzy as a consequence of being whirled about. Children, however, seem not to be so easily affected. Perhaps the necessary connections within the nervous system are only in process of formation in childhood and thus the difference in such responsiveness between children and adults may be accounted for.

It is also interesting to observe that many deaf persons lack the functioning of this equilibratory apparatus. They are thus much more troubled by the ordinarily simple matters of maintaining balance than are persons with normal equilibratory structures. They are dependent upon visual cues for their balance responses and in the dark are more likely to stagger or fall.

There is some question if true adaptation ever occurs in this field of sensory functioning. It is true that persons at sea do become accustomed to the pitching and rolling of the boat so that they are no longer troubled by it, "get their sea legs" as the saying is; but this may not be a true adaptation. It may be merely a changing of the inner connections so that the usual responses no longer take place. It may be a sort of learning process by which new and more effective responses become associated with the excitations coming in from the equilibratory apparatus. There is, also, a notable loss of these new responses after the person returns to the land for a time. Many persons suffer sea-sickness every time they go to sea. They apparently have to re-learn the responses most effective for life on shipboard.

Taste. Much less knowledge of the world for most people comes through the sense of taste. And it should be observed that much of that which is ordinarily spoken of as taste is not taste at all but smell or combinations of taste and smell with some other sensory experiences. Careful study of the tongue by means which will eliminate smell and temperature and pressure sensations reveals that the only experiences which can be properly designated as taste are those of sweet

and salt and sour and bitter. All else is a matter of combination. Proof for this may be found in the experience of most persons. When the head is stopped-up with a cold it is commonly observed that food does not taste normally—because the smell factor has been temporarily eliminated. The same food substances differently prepared produce what we call a difference of taste but these may not be really taste differences, unless the method of preparation adds to or reduces the amount of those substances which actually affect taste. Differences of temperature are frequently mentioned as differences of taste but are not strictly so. Mashed potato when it is warm is said to taste very different from the same mashed potato served cold. But the difference is actually a difference of temperature. And there are often associated differences of pressure which contribute to the tastes of everyday foods quite as much as the associated factors of smell and temperature.

The sensory apparatus for taste is in the form of buds set in the tongue, the soft palate and the pharynx. These have small apertures into which substances flow and there stimulate the sensory endings. From these buds sensory neurones convey the excitation to a center in the medulla. From there up to the cortex of the cerebrum the path of excitation is not so well known. Apparently it finds its cortical ending underneath the tip of the temporal lobe.

Complete adaptation to any one of the tastes is difficult to achieve; but partial adaptation is a common experience. Food which at first seems a little too salty after a little does not seem to be so salty. And there are associated contrast phenomena. After eating something which is very sweet a bit of sour food may appear to be insufferably sour. Candy after lemonade may appear to be far sweeter than it would ordinarily.

Smell. This has formerly been a far more important contact with the surrounding world than it is in man today, especially for man in our type of civilization and culture. If

we still went about with our heads near the ground we should probably find far more use for our ability to smell than we do with our erect posture and our heads far from the ground. Furthermore we have come to dislike smells to such a degree that many persons carefully avoid even those odors which are actually agreeable. There are so many kinds of odors that no satisfactory classification has yet been achieved. Even terms for them are difficult, and we ordinarily apply to the odor the name of the substance whence it comes.

The area containing the sensory endings producing smell experience lies in the nasal cavity but is so located that the ordinary passage of air through the cavity in breathing may not affect it. The olfactory membrane, as it is termed, lies in a by-path. Consequently when we wish to be sure to have it maximally stimulated we are obliged to sniff, thus driving the stimulating particles into the area of this membrane. The nerves conducting the excitation pass directly through the bony wall of the skull into the olfactory lobe which lies just inside. From there the path of the excitation is very complex. Some fibers lead to a cortical area near the base of the brain well under the temporal lobe. Others go to the medulla and to points of connection with motor tracts. In the medulla there are contacts with excitations coming in from the taste buds and from the sensory organs of the body. Obviously an elaborate degree of association is provided for.

Adaptation to smell is also a common experience. Students in our various laboratories soon become adapted to the peculiar odors of each. Workers in tanneries, cheese factories, and the like become adapted to those odors.

Internal Sources. Sensory sources of information from the internal organs of the body cannot be classed as very prolific sources of knowledge and yet we should be notably lacking in the range of normal human experience without them. Of hunger and thirst almost every person has had

some experience. They thus fortunately need little description because exact descriptions of these experiences are curiously difficult.

It is now well established that hunger sensations are aroused by contractions of the walls of the stomach more vigorous than those of ordinary digestion. Any device which will stop these contractions, tightening a belt for example, will check the hunger sensations. The ingestion of something whether it has food value or not will likewise stop the hunger. Thirst appears to come from the stimulation of sensory endings in the walls of the pharynx. Any condition of the body whether general or local which results in the dryness of the mucous membrane of the pharynx will cause thirst. And, correspondingly, whatever restores to this membrane the necessary moisture, whether a change in the general condition of the body or the local application of moisture, will remove the thirst.

Of other sensory apparatus and its functioning within the body even less is known. There seems to be some mild response to temperature stimulation in some portions of the alimentary canal. Of pressure sensations from the alimentary canal there are unquestionably some but because of the great difficulty of experimentation with them we know very little indeed about them. Pain from the internal organs probably exists but here again we are very much in ignorance. Our knowledge comes largely from reports of response in surgical operations performed under local anesthesia which are not very satisfactory because of the great possibility of responses being checked or altered by the anesthetic technique. Nausea is certainly a sensory experience from the internal organs. It is commonly assumed that this is in part at least due to a reversal of peristalsis.[7] Many of the pains aroused by internal bodily conditions do not appear to the one who experiences them as coming from the inner re-

[7] *The normal movements of the walls of the stomach and intestines in the process of digestion.*

gions of the body but appear to be located on the surface or within the limbs. This is doubtless due to the fact that sensory nerves from the internal organs enter the spinal root ganglia and there come into effective contact with the sensory neurones from the surface and limbs of the body thus producing the misleading localizations.

It is interesting to observe that in the everyday life of the healthy human being sensory experience from the internal organs plays a very small part. We are ordinarily not aware of our internal organs and the processes there going on except when something is going wrong. But of our sensory contacts with the outside world we are constantly aware. We live with the outside world rather than with the organic world within us, so long as the latter is able to take care of itself.

Hearing (audition). Through our ears comes a vast amount of the knowledge which we acquire in this world. So much comes through this source in fact that it is very difficult for us to imagine what life would be without it. The world of the congenitally deaf is a world which we who hear cannot imagine, for theirs is not merely a quiet world but a totally soundless one. Our adult world of auditory experience, however, is far more complex than the simple contributions of auditory sensory experience. The sounds quickly become associated with very important meanings. A soft purring whirr means the approach of a smooth running automobile. A bright high whistle means a bird in the tree. A clear round vocal tone interrupted at regular intervals by what we term consonants means that someone is calling me. An elaboration of this means a great variety of things, a spoken language. But our attention must first be given to the simplest form of auditory experience, that which is acquired directly through the auditory apparatus.

Of these acquisitions there may be said to be two general classes, the tones and the noises. The former are characterized notably by pitch (as high or low), although most of them

have some noise aspect. The latter are largely lacking in tonal quality but do have some pitch. There are noises which are shrill and high; there are noises which are low and woody. Some noises are continuous, as the hissing of steam. Some are short and sharp as the fall of a stone on a tin roof, or the crack of a whip. Another feature of auditory experience is the qualitative difference in human voices and in sound-producing instruments. These are important because of the wealth of meaning which comes to be associated with them. The sound of the mother's voice can be recognized by very small children as different from the sound of another person's voice saying exactly the same things. We are even able to recognize the voices of our friends over the telephone or the radio by this peculiar quality. We can tell with our eyes shut the difference between a violin and a guitar and a piano, although each instrument may be producing a tone of precisely the same pitch. These differences are usually designated as differences of *timbre*. Other features frequently of importance are produced by the combination of sounds simultaneously produced. Two tones of the same pitch will reinforce each other. But two tones produced at the same time of slightly different pitch do not quite reinforce each other but produce a tone which rises and falls in intensity as there is recurrent reinforcement and cancellation, called a beating tone. Sometimes two tones of somewhat greater difference in pitch result in the appearance from somewhere of a third tone, much lower, called a difference tone. Such tones appear frequently when musical instruments are played together and often add much to the beauty and effectiveness of musical compositions.

The stimulus which sets the auditory apparatus into operation is vibration in the surrounding medium of a sort which can affect the auditory apparatus in the cochlea of the inner ear. This surrounding medium is ordinarily the air but if one hears while in swimming with head submerged then the

surrounding medium is water. These vibrations are recurrent forward and back displacements of the particles of the air set up by whatever caused the sound stimulus, the stone falling on the roof, the bird singing, the engine of the passing automobile, or the larynx of the person calling to me. These vibrations, known as sound waves, can be graphically

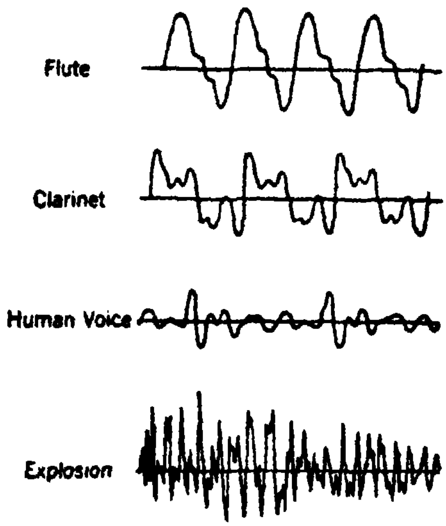

FIG. 10. Graphic presentation of sound waves. (Reproduced from Miller, D. C., *The Science of Musical Sounds*, by permission of The Macmillan Company. This reproduction as modified in *Psychology, A Factual Textbook*, by Boring, Langfeld and Weld, reprinted by permission of the authors and the publishers, John Wiley and Sons, Inc.)

represented by a curved line which alternately rises above and falls below a base line. For very simple tones such a curve will be very simple but for very complicated tones it is very complicated. The accompanying diagram will illustrate this excellently. When the curve varies far above and below the base line, then the forward and back displacement of the air particles is strong and the tone we experience is accordingly loud. When the curve moves but little from the base line then the tone is very soft. When the vibrations per second are very few the tone is of very low pitch. When they are many per second the tone is of much higher pitch.

Differences of timbre accompany differences in the form or complexity of the wave.

Adaptation in the auditory field is somewhat uncertain because of the easy confusion with the effects of attention. It is true that after a little we fail to notice the ticking of the living-room clock and the roar of the automatic heater in

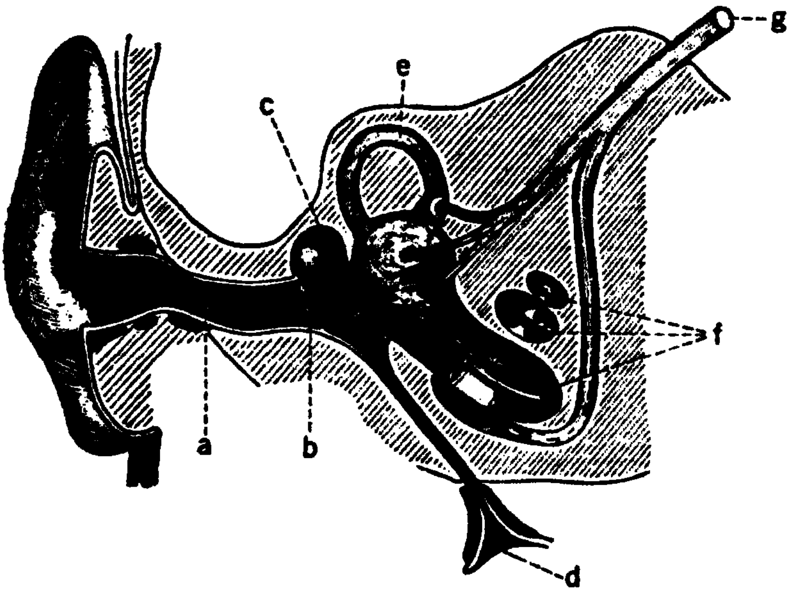

FIG. 11. Diagram of the inner ear. (Reproduced from Hough and Sedgwick's *Human Mechanism* by permission of the publishers, Ginn and Company.)

the basement, and that men working in very noisy places after a while lose awareness of the noise. But these changes may possibly be a matter of attention shift rather than of adaptation. Certainly when such noises cease or there is any marked change in them we quickly become aware of them again. This would make it look more like an attention phenomenon.

The sensory apparatus which provides us with all these responses to sound stimuli is one of the most complicated of our equipment. The sound waves set the eardrum into corresponding vibration. This in turn sets the little bones

of the middle ear into movement and these cause vibrations of the oval window by which similar wave movements are set up in the fluid of the inner ear. Then by some means not yet well understood [8] the sound waves are in the cochlea transformed into nerve excitation.

From the cochlea the auditory excitation is conveyed by the auditory nerve to the medulla where other neurones carry the excitation to a center in the thalamus from which yet other neurones carry the excitation out to the cortex of the first temporal convolution. From there the many connections are made which are necessary for the rich meaningfulness of response that is so rapidly acquired in connection with these experiences of sound.

Visual Sources. Through use of the eyes comes a vast proportion of that which we can learn. In the next chapter will be told the necessary facts concerning visual perception of objects, of space, of letters and words, and the like; but here attention must be first given to the simple facts of largely uncomplicated visual experience. Children very early distinguish between colors, but naming them is a later achievement as it involves the establishment of meaningful responses in association with color differences.

Of the simple color differences themselves there are a very large number. These are customarily distinguished by classification into two groups, the chromatic and the achromatic. The *chromatic* experiences are those commonly designated as colors, the reds and the blues, etc. These are first listed from the spectrum (rainbow) which produces a long series of colors from red through orange, yellow, green and blue to violet with many gradations between. But there are in addition certain colors which do not appear in the spectrum. These are the purples. Altogether it is possible to experience, under carefully controlled experimental condi-

[8] For the different theories for the explanation of this see the following:
Boring, Langfeld, and Weld, *Psychology*, chap. 5.
Murchison, C. (Ed.), *The Foundations of Experimental Psychology*, chap. 7.

tions, as many as 150 or more different chromatic qualities. In addition to these there are the achromatic experiences. These are the grays which range all the way from white through neutral gray to the blackest black obtainable.

It must be observed also that for each of the chromatic colors there may be many differences of brilliance. Red is not just red but is also a degree of brilliance. One and the same red may be very brilliant or rather dull. If this brilliance for any chroma is raised very high the experience gradually loses in its chromatic quality. If it is reduced the chroma also tends to disappear. Still further there must be included all the gradations of what is termed differences in *saturation*. These are common experiences of everyday life but not commonly observed as phases of color experience. When any one chromatic color, red or blue for example, is mixed with a gray of the same brilliance the result is no change of chromatic shade but a reduction of saturation, the color looks more and more "washed out." Doubtless that term has come from one of the commonest of experiences with changes of saturation. One may purchase a garment of rich color, well-saturated in these terms. After going through the laundry it appears in a disappointingly desaturated fashion. It has lost much of its richness. It looks as though it had been mixed with much gray. It has been reduced in saturation. As there may be these gradations of saturation for any of the 150 or more different chromatic colors and for most of the degrees of brilliance of each of these colors it is obvious that the actual number of different color experiences is vast indeed. It has been estimated at as high as 35,000.

Many experiences in life are associated with the *mixture of colors*. Strictly speaking, this term, mixture of colors, is rather misleading because we do not mix colors, which are human experiences. It is the stimuli to visual experience which are mixed. The light waves which produce an experience of red can be mixed with the light waves which produce green and we can observe the effect upon us. We call it

color mixture but that is obviously not a very accurate use of words.[9]

Surprising as it may seem, there are some lights which if mixed produce a complete loss of the original colors and produce an experience of brilliance or gray and nothing more. A certain blue and a certain yellow will do this. So will also red and a slightly bluish green. Actually it is possible to find for any chromatic color some other which is mixed with it at just the right brilliance and in the right proportion will have the effect of canceling the chromatic qualities and producing merely a sensation of gray. The pairs of such opposites are known as *complementary colors.* The mixture of non-complementary colors produces partial effects of cancellation, but the details of this must be omitted here, interesting as they will prove to be for those who have time to read further.[10]

Adaptation in the field of visual experience is of frequent occurrence but is attended by certain after-effects not found in the other sense fields. The usual and now familiar phenomena of reduced sensitivity is a matter of daily occurrence. Upon passing from a brightly lighted room into one that is poorly lighted one at first finds himself almost blind. He has been so completely adapted to the bright degree of illumination that he is no longer responsive to weak visual stimuli. But after being in the dark room for a few minutes the discovery is made that after all the room is not so very dark, light is visible coming through cracks in many places not at first noticed. Upon going into a room illuminated with red lights the effect at first is that of marked redness but after a little the redness seems to disappear and the illumination takes on more of the familiar character of an arti-

[9] Care should be exercised here to avoid confusion with the mixture of paints which produce very different results from the mixture of lights because paints are substances which absorb certain lights and reflect others.

[10] Titchener, E. B., *A Textbook of Psychology*, pp. 59-92; Boring, Langfeld, and Weld, *Psychology*, chap. 4; Murchison, C. (Ed.), *The Foundations of Experimental Psychology*, chaps. 4, 5.

ficially illuminated room. Putting on and the wearing of colored glasses for a time will produce a similar change of experience.

But adaptation, it will soon be observed, is attended by a curious and interesting after-effect. If one goes into a room illuminated strongly by red light and after becoming fully adapted to that light one passes suddenly into normal daylight, the first effect is that of a great increase in the brilliance of all greens in the visual field. It was pointed out above, it will be recalled, that a bluish green was the complementary color of red. Hence the experience of becoming adapted to red has made the person far more sensitive to the opposite or complementary color. If this rule is kept in mind it is possible to predict what will be the after-effect of stimulation to any particular color of light.

What are known as *after-images* constitute an important feature of visual experience and often a very useful one. Of these there are two kinds. The *positive after-image* is the continuation of a visual experience without change of color for a brief moment after the stimulus has been removed. After inadvertently looking at a bright light for a moment one frequently experiences the same light for a brief time after shutting the eyes or turning away. This is utilized practically in the production of the moving picture show. The pictures thrown on the screen are, as everyone knows, a succession of pictures in each of which many items are identical. But the observer experiences not a succession of pictures but a single picture on the screen because the timing is so nicely controlled as to have the gap between pictures filled in the observer's experience by the positive after-image from the just preceding picture. Watching a lantern swung in a circle often produces the effect of a long curved line of light. This is because the positive after-image does not die out immediately and so gives the lingering effect from where the lamp had just been.

Negative after-images come after the positive after-image has completely disappeared. And usually after a momentary interval. This can be readily demonstrated by looking at some brightly illuminated colored field (cloth or wall or sheet of paper) for a few minutes; and then either closing the eyes gently (but completely) or looking at a gray wall. At first a positive after-image of the color may be experienced. This will soon disappear and shortly after another after-image will appear but of the complementary color. This is the negative after-image. When these have once been discovered they will be observed with far more frequency in everyday life than is anticipated. Ordinarily we do not stimulate the eyes in a manner to isolate or to bring these phenomena of vision to our attention.

It should also be observed that the color of an object or field may depend greatly upon the color of the immediate surroundings. A bit of gray ribbon laid across a richly blue dress is likely to appear slightly yellowish, just as a bit of such ribbon placed on a yellow field will look slightly bluish. This is the contrast effect and is one which designers must frequently consider. In the illustration given one pair of complementary colors was used but any other pair would *have worked equally well. It is now well-established that* the contrast effect is in the general direction of the complementary of the color of the field which induces the contrast effect.

Careful experimentation has revealed that the sensitivity of the human eye to colors is not the same over the whole field of vision. That point in the eye which is used when we look straight at something (the fovea) is a point which produces chromatic experiences better than any other place in the eye. But it is not as good for the sensing of mere light and shade. The extreme edges of the retina are by contrast far less effective for colored vision but much better for the sensing of light and shade, for seeing things at night, for what is often referred to as twilight vision. It has some-

times been said that we are color blind in the extremes of the field of vision but this is an exaggeration. It is true, however, that in the extremes of the visual field, often termed the periphery, we are far less sensitive to the reds, blues and yellows and beyond a rather limited field are unable to sense green no matter how strong the stimulus.[11]

From parlor stunts most persons have discovered the existence of the blind-spot. There is one of these in each eye. It is the place where the bundle of nerves carrying the visual excitations to the brain passes out. For a long time it was supposed to be a place of complete blindness but in recent years certain experimental studies have made this questionable. However, the amount of vision from this spot, if any, is probably too slight for any practical value. That we do not ordinarily notice the blind-spots is doubtless primarily due to their location. They are so located that an object in the field of vision which would fall on the blind-spot of one eye would not fall on the blind-spot in the other. Hence one eye would compensate for the other.

A curious but commonly interesting fact is the existence of *color-blindness*. There are a considerable number of persons who are from birth deprived of the possibility of much of the visual experience the normally sighted enjoy. These are the color-blind. They are not all alike either in the nature or the degree of their defect. Some are a little lacking in sensitivity to certain colors and are thus easily confused while others see no chromatic colors at all. To the latter the world is a field of whites and grays and blacks, as lacking in chromatic experience as if they lived in a world of colorless pictures. The most common form is known as red-green blindness because of defect in the sensing of these

[11] Ferree, C. E., and Rand, G., "Chromatic Thresholds of Sensation from Center to Periphery of the Retina and Their Bearing on Color Theory," *Psychological Review*, 1919, 26, 16-41, 150-163.

Ferree, C. E., and Rand, G., "The Absolute Limits of Color Sensitivity and the Effect of Intensity of Light on the Apparent Limits," *Psychological Review*, 1920, 27, 1-23.

colors. Such persons see all grays and blues and yellows and their combinations without trouble. Then there are much more rarely instances of persons who sense the grays

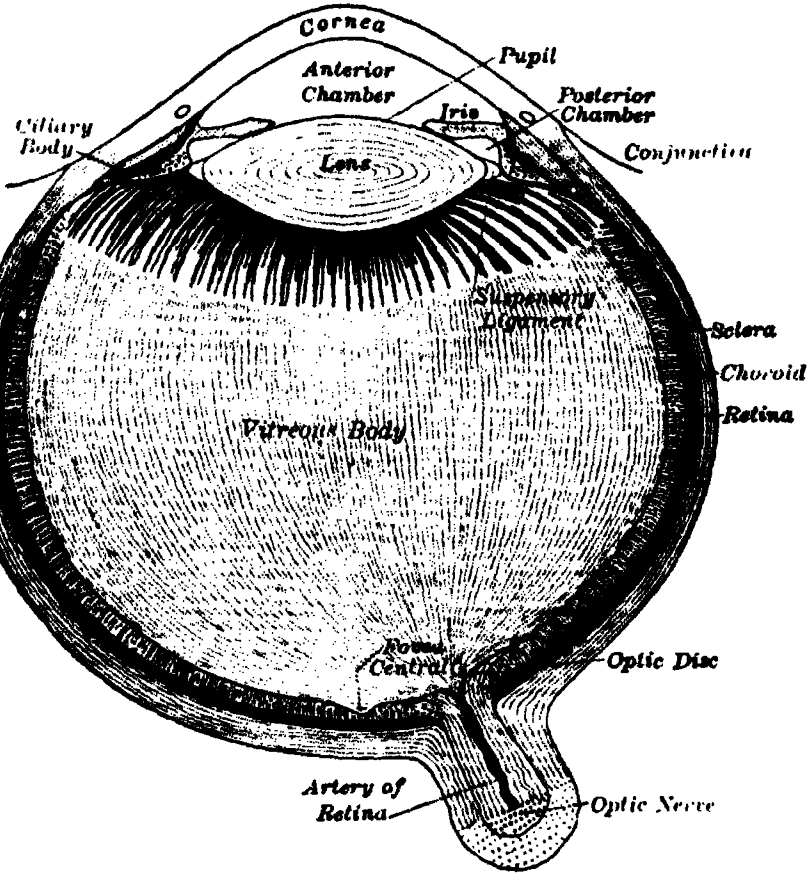

FIG. 12. Diagram of the eye. (From *Psychology*, by B. B. Breese. Reproduced by permission of the publishers, Charles Scribner's Sons.)

and other colors but cannot sense blues. Generally speaking to color-blind persons the colors for which they are defective appear to them as a gray of some degree of brilliance. For some reason still unknown color-blindness occurs more frequently in males than in females.

The Eye and Nerve Tract. Of all the sensory end-organs the eye is the most complicated. It must of necessity be so

in order to mediate the many different kinds of experiences just described. In the accompanying diagrams it is well to observe that the sensory endings in the eye do not point outward toward the incoming light waves but inward toward a dark coat of the eye, the choroid. It should also be noted

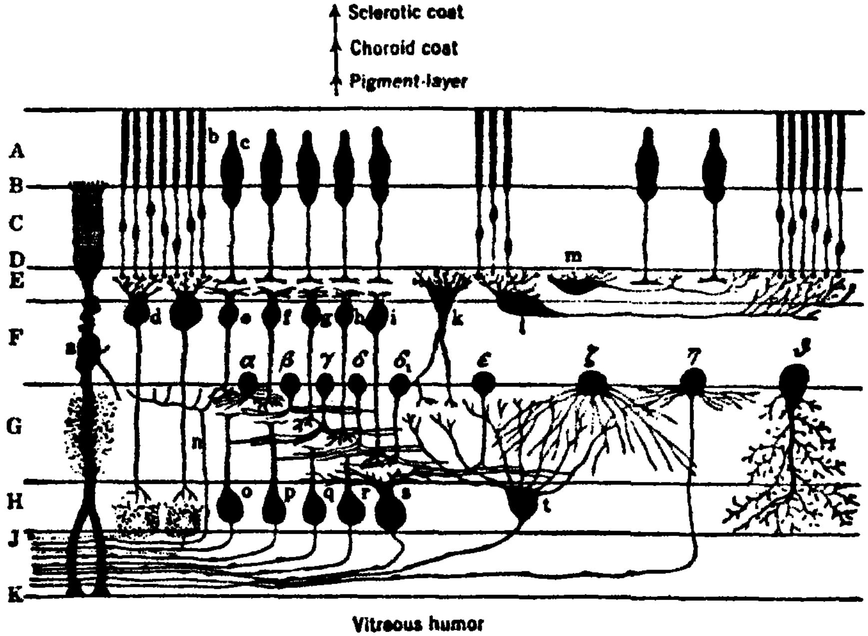

FIG. 13. Cross section of retina of the eye. (From *Psychology*, by Boring, Langfeld and Weld. Reproduced by permission of the authors and of the publishers, John Wiley and Sons, Inc.)

that the sensory endings in the retina are of two types, the rods and the cones. These are known to have specialized and different functions. The cones are specialized for responsiveness to chromatic stimulation. Of these there is a vastly greater proportion in and around the fovea where color vision is at its best. Out toward the periphery of the eye the rods are proportionately more numerous and it is there that we are best equipped for twilight vision and where color vision is not so good. There are persons who have a defective rod vision, and as a consequence have great difficulty in seeing things at night. The axones of the optic

nerve will be observed as a large bundle passing out at the back of the eyeball. From there they carry the visual excitation up to a center in the posterior region of the thalamus from which the great spread of nerve fibers known as the optic radiation carries the excitations out to that area of the occipital lobe of the cerebral cortex known as the visual area.[12] The effects of the interrelations possible in the cortex will be found in the next chapter where the further development of associations of sensory experience are presented.

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[12] See drawings in Herrick, C. J., *Introduction to Neurology* (2nd ed.), chap. 14.

Chapter VII

PERCEPTION

When the response to sensory stimulation indicates the influence of learning it is common practice to designate such a response as a perception. When the baby turns its head toward a noise, we recognize that there is response to sensory stimulation, although it would not ordinarily be designated as perceptual: but when the adult hears a noise and utters the correct name for it, we say that a perception has taken place. When a pedestrian merely jumps at the sound of an automobile horn, few would think of that as anything more than a very primitive sort of response to sensory stimulation; but, when a pedestrian upon hearing the horn of an automobile turns and remarks that it is his neighbor's car, then there is the indication of learning effects and it is a perception.

When perception is thought of in this way, the relationship of reading and other forms of personal experience to perceptual development can be readily recognized. The sight of a hill may mean little to the child sliding upon it, but to the person who has read widely the sight of that hill may bring a wealth of responses in terms of thoughts about glaciers, the movement of earth particles, the melting of the glaciers and the deposition of these earth particles over very long periods of time. To one person a yellow flower may be something that is merely bright and pretty; but to another the yellow flower may stir responses in the form of memories of seed-planting, of watching the plant grow, of seeing the blossom come, of books, and names and associated persons. A certain combination of auditory experience

produced by air-vibrations set up by the voice apparatus of another person may be reacted to as just a succession of noises, and it may be reacted to by thoughts of the days when one studied German in high school, of the teacher, of the book used, of the meaning of those sounds, and perhaps with impulses to speak in the same language. Education, formal and informal, may thus be properly thought of as contributing constantly to the development and change of the perceptions of which any one individual is capable. The more education and experience in the world the more meaningful will the responses to sensory experience become, the more perceptions will have been established. The more education and travel and reading and study one has, the more kinds of perceptual responses are possible. The infant shows very little of such perceptual response, but as soon as the baby manifests what appears to the adult to be perceptual in nature much is ordinarily made of it. Perhaps entries are made in the "baby book."

Careful examination of any simple form of perceptual behavior will quickly reveal that perception involves the arousal of responses for which the original stimulus seems not to be present. For example, the small child is shown a watch. The feel of it is experienced, the sounds of the tick and of the word "watch" are heard, and the child is stimulated to repeat the word for himself. Later on when that same ticking sound appears again the child may utter the word "watch" and have perhaps a recollection simultaneously of the feel of holding it in the hand. Thus responses which were a part of the original experience with their own special stimuli are later aroused by a part of the original stimulating situation. To the person who has been at Niagara Falls the sound of those syllables Ni-ag-a-ra will arouse visual recollections of the experience of looking at it, auditory recollections perhaps of the sound of its roar, and possibly even something of that same queer feeling which one has upon looking down from the great heights or of

standing at their foot and looking up. But in the person who has never had such experiences the sound of the word Niagara may bring up merely recollections of a picture in a book or of a spot on a map. Both such experiences are definitely perceptual and both illustrate the arousal of parts of a former experience for which the original stimuli are no longer present; but they are obviously very different because of the difference in the former experiences with the word Niagara.

Perception of Objects. The perception of an object will, upon examination, be found to conform to the general principles presented above. The perception of an object can be traced to former experiences with that object, and will be observed to involve the arousal of traces of those former experiences. This may best be understood by observing the development of an object perception in one's self. Go, for example, into a machine shop. Very soon some object will be seen which is largely meaningless. One does not know what it is called nor what it is for. Inquiry of the machinist will reveal its name and its use, perhaps he will demonstrate its use and he may even let the visitor go through the motions of using it for himself. Then later on the sight of that same object, or another quite like it, will call to mind traces of the machine-shop experience and the person once ignorant can now say that he knows what it is and what it is used for. Many succeeding experiences with that object may gradually bury that original meaning-establishing experience but the object will continue to arouse a perception which involves its name and its use. Thus is an object-perception established. This it will be observed involves ordinarily the utilization of several kinds of sensory experience with the object. One of the best ways to learn rapidly is to make the learning experience involve as many kinds of sensory experience as possible.

Object perception constitutes a very large part of the early training of every individual human being. Children

are given a great variety of toys, many of which are small duplicates of normally larger objects, they are supplied with picture books from the viewing of which, with the help of adults, many more objects and their names are acquired. Stories are constantly told to children or read to them, the psychological import of which is the development of object perceptions: stories of animals, of places, of people, of objects and how they are made. A visit to a kindergarten or the primary grades of any good school may be in this connection a most illuminating experience. One will see there the process of developing object perception going on at every turn.

Illusions in Object Perception. This form of response which involves both sensory stimulation and the arousal of formerly associated sensory responses may be found to operate sometimes in a misleading fashion. If, for example, one is quite well-acquainted with a certain girl who regularly wears a red overcoat, and then some day sees a girl in that kind of a red coat just going out of sight around a corner, one is probably quite willing to testify that the friend went around the corner at that particular moment. Perhaps, however, the friend had loaned her overcoat to another girl of about her own size and that it was the other girl who went around the corner in the red coat. In this case the sensory impression of red in a certain pattern has long been associated with the habit of responding in terms of the girl who usually wears that coat. Thus it is not surprising that the sight of the red coat should arouse all of the usually associated responses which mean to the person who has this perception that the well-known girl was seen going around the corner. Later he will be surprised to learn that he was mistaken, that he had experienced an illusion of a very common form. Almost any reader will be able, after a little effort, to recall similar instances in his own experience. The author himself once, when partially asleep, mistook an overcoat and hat on a rack in the corner of the room for a man

standing in that corner. Only the sight of the stick in the place where the head and face should be dispelled the illusion.

Perception of Place. Objects are not, however, perceived in complete isolation. They are always perceived as being somewhere. There is thus in the perception of an object a part of it which means place. A tree is not perceived as standing alone in a spaceless void. It is experienced as in relation to the ground, as being at some distance away, and as off in some specific direction. Sometimes these features of perception are treated separately as the perception of space, but it will not take much consideration to realize that space is largely a matter of our perception of objects in relation to other objects and then of our thoughtful abstraction from such perceptual experiences. In our thought we may abstract and develop concepts which have no counterpart in perceptual experience and we actually do this very often, but we should not thus be misled into talking about the perception of space as though it were like the perception of an object. Perceptions of location and distance and size are, however, a part of most perceptual experiences and these parts of the experience call for examination.

Suppose, for example, that someone lays a pencil along the back of the left hand. We have at once the perception of a pencil (perhaps, although it might at first be the mere perception of something unnamed along the hand) against the left hand. Our many experiences with the visual shape, the temperature and the pattern of cutaneous sensations produced by a pencil arouse in us this perception. But we can perceive a pencil by one hand as well as by the other. And we interestingly enough know almost as quickly on which hand the pencil has been laid. By careful experimental procedure it would be possible to apply such an object to either hand with exactly the same pattern of pressure sensations and temperature sensations in each but the per

son so stimulated would promptly perceive the exact location. It is this location which needs examination.

How this is achieved can be easily observed by anyone for himself and in the process he will see again the essential features of every perception. Let some assistant touch him (keeping eyes closed) now in one place and now in another, on the cheek, the hand, the shoulder, the foot, and so on. If one watches himself very carefully when this is being done, one will note that there is a slight, very slight, tendency to move toward the point touched and most persons will also note the frequent arousal of a visual image, picture in the "mind's eye," of the place touched. These visual and motor associations are the remnants of the experiences through which we learned the perception of location, of left and of right. We did not originally have these perceptions. We learned them very early in life, or most of them. It is instructive to observe also that there are some places on the body even in mature years for which perceptions of location are very poor indeed. These are the parts of the body which we cannot see except by much effort, perhaps only with the use of mirrors. These are the places on the body which we seldom touch with our hands and then only with so much effort that we do not often try to do so.

The *visual perception of place* is also to a large degree interpreted in terms of associated responses. In this, however, there is probably something as original and native as is color or sound or taste. This is the existence of pattern. It now seems fairly certain that the most primitive form of visual experience is that of a poorly detailed pattern against a background. The baby probably experiences this distinction of the outline of the mother's figure against the general background or the outline of the window against the relatively less stimulating wall of the room. Into this experience soon comes, so far as we know, distinctions of place, probably through the associations of the particular pattern with movements of turning the head and eyes, or both, to-

ward the mother or the window or whatever it may be. As the object is examined more and more details come to stand out in it, a part of the pattern comes to stand out against the rest as background. Anyone may experience much the same thing for himself by going through the process of learning to look through a microscope. When one first looks through the eye-piece there is the experience of a spread-out pattern against a light background, but few of us can see much detail in that spread-out object the first time. There may be some unevenness of lighting but more than that few of us observe. Repetition and the help of the book or the instructor soon lead to the observation of more and more detail within the object. Observation of detail is accompanied by movements of the eye so as to bring each part and detail upon the fovea, the point of clearest vision. Thus general relationships within a visual pattern develop.

In the larger field of vision of everyday life there is included obviously far more than is possible with the eyes fixed. Ordinarily we swing the eyes about and move the head also thus greatly increasing the field within which perceptions of location can be made. The achievement of clear vision of objects in the many different possible positions, up and down, left and right, and all the possible combinations, involves much eye and head movement. This establishes a vast range of kinesthetic association with the sight of the particular objects in the particular positions. After much such movement has taken place, after the individual is much practiced in responding visually to objects in various positions, the actual completed movements may no longer be necessary. The mere presence of the tendencies to such movements may be enough. We have all had, or can have, the experience of keeping the eyes fixed upon some one spot and observing our perceptions of objects in other locations but without actually moving the eyes out to them. When this is done careful observation is almost certain to reveal the presence of sensations from the tensing of the eye mus-

cles in preparation for the appropriate movements which would take place were they not inhibited by the determination to hold the eyes fixed upon the selected spot. Altogether this contributes a mass of kinesthetic association which constitutes a very large part of the meaning we know as the perception of location. Perception of the location of sounds is psychologically somewhat similar, a discussion of which will be found a little farther on.

Perception of Distance. This is one of the perceptions we all have which is interesting because it is not the perception of an object but rather the perception of relations between some object or objects and ourselves, or between one object and another object. The person who is born blind must obviously be largely dependent for his perception of distance upon kinesthetic experience. He must move his hands back and forth over the table in order to learn its size, obtaining thereby familiarity with the amount of movement of his hands and arms necessary to compass it. Then when he moves his hands over a smaller table comparison becomes possible. Larger distances must be walked through in order to make them familiar and recognizable. They must be walked through and brought into association with hand and arm movements. We who are sighted have obviously the additional aid which comes through our vision; but we in childhood do much the same thing as does the person born blind. With sighted children, however, the kinesthetic experience is at once associated with the visual. Children may often be seen marking off distances and saying, "Let's run to that place." They are by such means developing perceptions of distance. They reach for things which are far away, grasp them and bring them close to. They run to places and back again; and when they have run to some distant point they look back to the place from whence they have come before running back. Thus are the perceptions of distance developed.

But in all this process of developing distance perception

there are incidental factors operating which are not so readily observed. One of these is the size of the retinal image and its changes. When an object is close to the eyes the image of it represented upon the retina must obviously be much larger than it is when the object considered is far away. A man close to the eyes produces a larger image on the retina than the same man five blocks away. If we stand and watch the man walk away from us through the entire five blocks we perceive the man as walking away from us. We see his legs move and we have learned that those visual experiences mean walking and we may observe that the relation of the man to the street crossings and the buildings changes. These are cues which serve to arouse the perceptual experience of the man walking away from us, becoming constantly at a greater distance from the eyes through which the perception is aroused.

It is well, however, to observe that our perception is definitely that of the man moving away from us, although as he moves away his image upon the retina of our eyes must become progressively smaller. It is a curious but important fact that these changes in size of the retinal image do not produce in us the experience of seeing the man grow steadily and correspondingly smaller. Perhaps very young children do have their perceptions of size affected by every such change in the size of the retinal image. Of that we are not certain. But it is certain that in older children and in adults a habit has become established of correcting for this progressive change in the size of the retinal image, so that, within certain limits, a change in the size of the retinal image does not produce the illusion that the person or object looked at is changing in size. This depends also upon the general setting. If the image of the man should become smaller, without the associations with the streets and the buildings normal to movement away, then we should of course have the astonishing experience of seeing the man grow smaller. In some recent moving picture presentations this effect is

produced and capitalized. There is also to be observed in this connection that the constancy of size in visual perception is limited to the range of common or greatest experience. Beyond these limits we have all observed the curious effects of the unusual retinal image. When one stands on a very high place and looks down into the street below at the people walking about, these human beings appear to be noticeably tiny. We perceive them as human beings because of their shape and familiar movements; but they appear to be ludicrously small because we are quite unaccustomed (we have no well-established perception responses) to having these responses in association with images so very small.

There are also certain definitely optical factors in the visual perception of distance which have their influence upon our perceptual responses. They serve no doubt as cues or aids in setting off the correct perception. One of these is the *difference in* the *retinal images*. The two eyes function much as would two cameras placed a little distance apart. If pictures were taken by two cameras so placed no one would expect the resulting pair of photographs to be exactly alike in every detail. Pictures taken for use in a stereoscope, once a common household object, are taken in this manner (although somewhat exaggerated). Careful comparison of them will quickly reveal the slight differences due to the difference of position. One can observe the same thing by holding the head quite still and looking first with one eye and then with the other. In observing the difference between thick and thin objects these differences in the retinal images are quite important—with one eye we may even see "around the corner" in comparison with what is seen with the other eye.[1]

[1] Try for proof of this the stunt of placing a napkin ring at arm's length from yourself on the table in front of you. Then with one eye closed try to spear the ring with a pencil. This can easily be done with both eyes open but without the aid of the difference in the retinal images it will be found much more difficult.

Looking at one object with two eyes also involves the phenomena of *convergence*. In order that an object may fall on the point of clearest vision in each, the fovea, it is necessary if the object is fairly close-to for each eye to swing a little inward. Then if the object should be moved a little nearer or a little farther away it would be necessary for the eyes to swing a little nearer together or a little farther apart in order to keep the object on the fovea of each eye. That this does occur anyone may readily demonstrate by watching the eyes of another as he looks at an object moving to and from in that fashion. If one serves as the subject for such an experiment one quickly becomes aware of the strain sensations from the eye muscles, when they are asked to do this somewhat unusual amount of work. Persons who have lost the sight of one eye have, for a time at least, a little more difficulty in perceiving differences in the distance of an object because they obviously lack both this muscular factor of convergence and the differences of retinal images mentioned above.

The range within which these differences of convergence function as factors in the perception of distance is not of course very great; but it is the range within which much of ordinary experience takes place. Estimates differ. Some say that these differences are influential up to a distance not over 100 feet. Others think them influential up to 250 or 300 feet. Beyond this latter distance the object of consideration is far enough away so that the lines of sight of the two eyes are practically parallel.

Adjustments of the eyes for differences of distance are not limited to convergence. There is a change also in the shape of the lens known as *accommodation* which must be included. This change in the shape of the lens, resulting in a change of the focal distance, is produced by a very small muscle known as the ciliary muscle which by effecting a reduction of tension upon the ligament holding the lens permits it to swell out or thicken up. The effect of this is the

same in the eye as that achieved in the focusing of a camera by changing the distance between the lens and the plate or film. It produces a convergence of the light rays exactly upon the retina of the eye and thus produces a clear image. The pull of the ciliary muscle in the eye may be felt by anyone who will rapidly shift some object back and forth from one distance to another in front of one eye. One can by so doing also observe the moment of time necessary after a shift before the muscle brings about the proper change in the accommodation of the lens, the moment required to bring the object shifted to a new distance into clear vision.

This factor of accommodation is also one which functions only within a limited range. Some say that changes in accommodation for objects already more than thirty feet away are too small to be of significance; while others think that it may be influential in distances up to as high as fifty feet.

The other cues or aids by which perceptions of distance are achieved visually are rather numerous and often so commonplace that they fail of observation. Clarity of outline or distinctness of the object looked at is frequently relied upon as a guide. When the artist wishes to give the one who looks at his picture the impression of distance he makes the outline of the object hazy. If the object is supposed to be close-to, the outline is made as sharp as it would be if we saw the object close-to. Illusions through the misperception of this item are common. Objects in a fog appear to have a hazy outline and thus are often perceived as being farther away than they really are; while persons going from a foggy atmosphere into a very clear atmosphere are often misled in matters of distance.

The relative position of objects also contributes to the perception of distance. When one object, for example, appears to be above the other and the appropriate relative sizes are maintained, then the upper object is perceived as being farther away than the lower. When the upper part of a tree appears in a picture to be growing out of the top of a barn.

the perception is immediately that the tree is standing behind the barn. Distributions of light and shade are likewise useful in producing these perceptions. Some object projecting from the side of a sun-lighted wall will be light above and shaded underneath. A ball standing on a table lighted from above will also have such a distribution of light and shade. But if this distribution of light and shade is reversed we tend to perceive an indentation in the wall or a concavity instead of a convex surface. It is interesting to observe also what art teachers speak of as geometrical perspective in drawing. There is the commonly taught statement that all parallel lines in perspective drawing meet at the horizon. The truth of this statement can be easily demonstrated. Lines that are known to be parallel, if drawn so in a picture quickly appear absurd, while if drawn in a manner to meet at the horizon in the picture they will be perceived as proper and natural. The failure to utilize this frequently appears in the pictures of small children who tend to draw in terms of their naive observations of the object rather than in terms of the proper pattern to produce the desired perceptions of distance. Railroad tracks leading off to the horizon in a picture appear to meet. They would present an absurd appearance indeed if they were drawn so that they were actually the same distance apart at each point in the picture.

Comparison with the size of objects whose size is a well-established perception commonly aids in our perceptions of distance. When one tries to judge the distance away of some object without such aid great difficulty is encountered. Standing on the seashore and judging the distance away of a passing vessel is for the untrained a very difficult task, fraught with many errors. But, for the person who is accustomed to judge distances without reliance upon comparison with familiar objects, it does not appear to be so difficult. Old sailors and others accustomed to such perceptions fre-

quently have much quiet amusement over the mistakes made by summer visitors at sea-coast resorts.

Auditory Perceptions of Distance are often still more difficult because there are so few cues with which the perceptions may be associated. The cue most commonly relied upon here is the intensity of the sound. Faint sounds are perceived as far away and loud sounds as near to. But obviously the person perceiving must be familiar with the ordinary intensity of the given sound when the source of it is close-by. A rooster crow if characteristic in every respect except for its faintness will be perceived as far away. Sometimes a telephone receiver gets a little out-of-order and the voice listened to is fainter than it should be. We then perceive the person speaking as far away, whereas the voice in the telephone receiver ordinarily appears to be close-by.

The quality of the sound is, however, a very important factor in this auditory perception of distance, although we may never be very accurate in its use. That the quality of a sound near-by differs notably from the same sound at a considerable distance can be readily demonstrated. Listen for instance to the whistle of a railroad locomotive near-by and then hear the same whistle at a considerable distance, preferably at a succession of different distances, and it will be promptly observed that the quality as well as the intensity changes with the distance. This qualitative change is a change in that quality described in a preceding chapter as timbre. Some of the overtones which contribute importantly to the timbre quality when the source of the sound is near-by are not strong enough to carry very far. Hence, when the source of the sound is farther away, they will be fainter or not apparent at all, thus producing the change of quality commonly observed. The firing of a gun close-by produces a different quality from that of the same gun away on a distant hill-side. Some persons become highly trained in the perception of these differences and are surprisingly accurate in their estimates of difference.

Perceptions of Movement also doubtless involve something which is original and native to the behavior of the nervous organism. This has come to be known through the discovery that the experience of movement can be produced without there being actual movement in the visual field. When, for example, a vertical line is exposed and quickly followed by a horizontal line in the position in which the vertical line would have been had it been rotated to the horizontal by movement either to the right or the left, there is produced the experience of movement if the alternation of these two lines is at a certain proper speed. If these two lines are alternated at a speed which is too great, the experience of movement disappears and there is seen only the two lines as if in continuous exposure; if the speed is slower than that optimum which produces movement, there is the possibility of experiencing a slight partial movement of either or both lines; but, if the rate of alternation is slow enough, the experience of the observer is that of simple alternation of two lines in two different positions. The experience of movement at the optimum speed already described is technically known as the "phi phenomenon." It is important because it reveals that the experience of movement is largely a central or cerebral process. It depends upon some sort of spread of activity in the cortex of the brain from one area or pattern stimulated to the other.

Much perception of movement, however, must apparently involve the now familiar phenomena of associations which give the meaning of movement. The factors in the perception of location have been described above. Now let it be supposed that an object is moving slowly over some surface of the skin. Such would arouse now one and then another of those perceptions of location which appear to be important factors in the ordinary perception of movement. When one location is perceived and then another and another with the associated visual perception of a moving stimulus, an ant for instance, the perception of movement must then

involve the association of cutaneous experience with visual. Some proof for this may be found in the illusion produced by very rapid movement. Sometimes the movement is so rapid as to make impossible the clear perception of any more than the place of starting and the place of stopping. Then the extent of the movement is greatly underestimated. This is assuming of course that the person is unable to see either the skin surface involved or the moving object.

The everyday visual experience of movement must be observed in two sets of circumstances, when the eyes are fixed and the object moves across the field of vision and also when the eyes are moving because fixed upon the moving object. When the eyes are fixed and an object moves through the field then there is probably the native movement experience described above as the phi phenomenon, because the moving object will stimulate adjacent areas or points in succession. But there are doubtless also associated with this the perceptions of different locations in the visual field which have grown through the many experiences of seeing and adjusting to objects in various positions. Here it becomes articulated with the details of the visual perception of position described above. The cinema reproduction of movement utilizes these processes. Actually the moving picture is a series of still pictures taken in rapid succession. They thus represent a moving object in a succession of positions. When these are reproduced by projection upon the screen, the viewer experiences a series of stimulations in rapid succession, with the result that he perceives the moving object as moving. Objects which maintain the same place upon the retina of the eyes are comparably perceived as continuing in the same location.

When the eyes follow the moving object, the object looked at remains constantly upon the same area of the retina, and thus is constantly in clear vision. Here it is the objects in the background which stimulate a succession of points on the retina and thus produce the experience of

movement. This apparent movement of the background can be readily experienced any day by merely watching a passing car or a person walking down the street and at the same time attending to the background rather than the car or the person. Why we do not ordinarily observe the background as moving under such circumstances and the car or person as standing still is again an example of that correction which takes place in our perceptual responses, a correction which has grown out of the many experiences we have had with such situations. To the person well-grown and with normal vision the habit has been long established that when the background appears to move and the object appears to be standing still then that is merely an illusion and that the facts are quite otherwise. Now and then this illusion is brought forcibly to our attention when we see in a news reel presentation an instance of where the photographer permitted the camera to follow the moving object. Then the movement of the background often becomes notably apparent. But the average attendant at the movie show either does not notice it at all or if he does merely passes it off as a curious illusion.

Perception of Direction. The means by which we become aware of the direction of an object to which we respond visually has been well indicated in the presentation of the perception of distance above. Those kinesthetic associations coming from movements of the eyes and of the head and body in order to bring the object into the clearest possible vision constitute the associations which give the meaning of direction. Doubtless these are acquired very early in life, but even after achieving mature years it is possible occasionally to observe experiences which bring about some improvement.

The perception of the direction from which sounds come to us is far less simple. It is complicated by the fact of greater difference of location of the two ears. With one on each side of the head sound waves strike them at different

times and in different ways. It is through these differences that differences in the direction of the source is learned. These differences become associated with visual experiences and the larger kinesthetic patterns of moving the head or entire body toward the perceived source or direction. It is these associated reaction patterns doubtless which give the full meaning of direction, but it is to the differences in pattern of auditory experience from the two ears that the differences of associated pattern are cued or related. One demonstration of this can be easily made. Any device which produces a simple brief sound, a snapper for example, will be found very easy of location by a blindfolded subject if the snapper is placed anywhere except at a point equidistant from the two ears. When it is held anywhere in a median plane between the ears there will be gross errors of apparent direction; but as the source of the sound is brought nearer to a line running through the ears the accuracy of perception of direction increases.

Illustrations of this appear with some frequency in everyday life. When one is seeking to perceive the direction of a sound coming from so far away that the difference of intensity at the two ears is negligible, there is great difficulty in its location. Again, it will be observed, that when the direction of a sound is in question people frequently turn the head this way and that in order to get the perception more clearly. The effect of this turning the head about must be that of increasing and decreasing the difference between the ears, thus bringing out the perception more clearly.

There are two other factors in the auditory perception of direction which are important but which involve primarily the nature of the sound wave and the fact that this wave in order to reach the ear and the opposite side of the head must pass around the head in order to get to the other ear. As the distance around the head will vary with differences in the direction from which the sound wave comes, it is likely to vary at the other ear according to the degree of

these differences. The phase of the wave may for instance be quite different at one ear from what it is at the other. It may be pushing in at one ear and pulling out at the other. And this difference may obviously be of any degree from complete opposite phase to precisely the same phase. Experimental studies have shown that our perceptions are very different when the phase at the two ears is different. It will be recalled also that practically all of the sounds we ordinarily experience are produced by very complex sound waves. These are composed of the fundamental and many overtones of different vibration rates and a special pattern of amplitudes (intensities) according to the particular timbre quality produced. As the sound wave coming from one side must pass around the head to reach the other ear, and as the distance around the head front and back may be different, it is obvious that some of these overtone waves will meet in like phase and reinforce each other, some will meet in opposite phase and cancel each other, and others will meet in various degrees of like and opposite phase. This means that the pattern of overtones will be different at the far ear from what it is at the near and, still more importantly, that this timbre difference will change with different directions of the sound source. Only when the patterns are alike at the two ears would there be no difference. This would occur only when the source of the sound is exactly the same distance from each ear, in the median plane between the ears, and this is notoriously the position in which it is almost impossible for us to perceive direction accurately.

Size of an Object. This is a perception in which many of the same features already presented will be found. The size of an object is determined by the number and nature of the perceptions of location aroused. Think, for example, or experiment a little, of the nature of the experience when a large object is placed against some portion of the body

surface; and also of the comparable experience when some rather small object is similarly touched. Looking at objects involves varying visual areas and varying perceptions of location within the visual field. The factors which produce the experiences of depth or distance must also be influential here, as in looking at very large and very thick objects. Some of the steps in the development of these perceptions may be observed when small children are playing with blocks of different sizes and shapes. As they handle them and look them over and put them together in a variety of constructions, the experiences which build the perceptions of size are in process of development. These like all other perceptions are the product of learning and are probably learned for the most part very early in life. Nice distinctions in the perception of size are frequently, however, an adult achievement. Practice makes many mechanics and sportsmen remarkably accurate in their perceptions of size.

Illusions of Size are also a fairly common experience. Where no visual associations are normally achieved our perception of size may be even ludicrously wrong. After the dentist has drilled out a cavity in a tooth preparatory to filling it, we may press our tongue into it and have a perception of size governed primarily by the amount of discomfort we have endured and the noise involved in the process. Lacking a visual association we are prone to perceive the cavity as vastly greater than it actually is. Visual mistakes in the perception of size are of frequent occurrence. In the discussion of factors in the visual perception of distance presented above there was mention of the effect of differences in clearness of outline. This may often produce absurdly false notions of the size of objects. Persons who have lived most of their lives in a climate where the atmosphere is rarely very clear find themselves grossly misled about the size or distance of objects in the landscape when they visit places where the atmosphere is ordinarily clear.

Many illusions of size have been observed and studied but they are not yet well understood. The following are a few of the best known of these illusions:

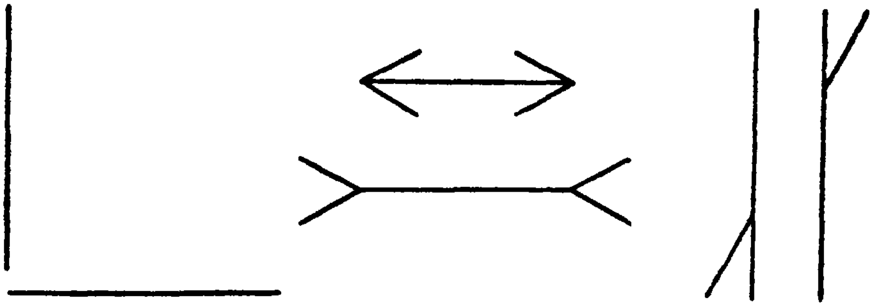

FIG. 14. Three famous illusions: a. Vertical vs. horizontal, b. Müller-Lyer, c. Poggendorf.

In the first of these the vertical line appears to most observers to be distinctly longer than is the horizontal line with it. Some have thought that this was due to differences in amount of muscular activity involved in looking over a vertical line as compared with looking over a horizontal line; some have thought that it was attributable to the shape of the eyeball and the differences of sensitivity in different areas of the retina; some have offered yet other possible explanations; but none is entirely satisfactory. The second of the illusions given, known as the Müller-Lyer, is another example of how habit patterns in space perception may serve to mislead the observer. In this instance repeated observation, it has been found, will result in the disappearance of the apparent difference in the lengths of the two horizontal lines. The third of these, known as the Poggendorf, is just another example of the same general principle. Perhaps the habit of correcting acute and obtuse angles in the direction of right angles may be one of the factors entering into the production of the illusion that the diagonal line here is not continuous.[2]

[2] For more extended presentations of such illusions see: Boring, E. G., Langfeld, H. S. and Weld, H. P., *Psychology*, pp. 250-256. Carr, Harvey A., *Introduction to Space Perception*, pp. 368-405.

Auditory Size. Still one more curiosity of perception needs to be mentioned. This also is a very common experience and is probably another good illustration of the nature of the perceptual response. Sounds of different pitches frequently give us the impression of being different in size. Technically this is known as the voluminousness of a sound. The very high notes of a pipe organ are commonly described as little, tiny, and the like; while the very low tones of a pipe organ appear to be vast, room-filling in their size. Between these extremes there is a fairly regular gradation of the voluminousness with changes in pitch. This is probably a perceptual associative phenomenon, one which has grown out of our experiences with high and low tones in relation to the objects of their production. Very high tones are produced by small animals or small creatures and so the association of smallness has become established. Likewise very low tones are almost as commonly associated with that which is large. The roar of a lion is produced by a very large animal while the squeak of a mouse by a very small one. Children who live near the seacoast must early associate a low-pitched roar with the vastness of the ocean. The low rolling thunder is associated with the vastness of the heavens, the huge black clouds, perhaps, with the mountains or open prairies. The sharp high-pitched cracking thunder is associated with cracks which are smaller in extent. There may be something native about this, as the color in a visual sensation for example, but many psychologists think of this apparent size of sounds as a matter of early-established associations, dating so far back perhaps in the life of each individual that the original establishing experiences are forgotten.[3]

[3] It is also true that some psychologists believe that this voluminousness is not only an original trait, or attribute of the auditory sensation, but that it varies with intensity. See Halverson, H. M., "Tonal Volume as a Function of Intensity," *American Journal of Psychology*, 1924, 35, 360-367, and Rich, G. J., "A Study of Tonal Attributes," *American Journal of Psychology* 1919, 30, 121-164.

Pain Location. In the study of human perceptions the location of pain may at first appear to be a monstrosity. It is true that the perception of pain presents many vagaries but the reasons for these are now pretty well understood and taken into consideration when physicians make their diagnoses. That they are perceptual, learned, responses can be readily demonstrated by observing the difference between the inexperienced child's report of the locations of his pains and those of an adult. Children are frequently most trying to the thoughtless adult by their absurd and impossible answers to questions concerning where the pain is. More experience with pain will result in better perceptions of location.

Cutaneous perceptions of pain location appear to be quite like any other perception of cutaneous location. A cut or jab is with most adults fairly well located. There are the familiar associations with visual experiences of the place damaged and the pattern of movements toward that place. But our perceptions of the location of pains coming from inflammation or congestion or injury within the body are more bewildering. Pain aroused by some abnormality of an internal organ of the body may appear to come from some area of the surface of the body quite remote from the organ actually involved. These have been carefully studied and the actual meaning of an apparent pain at one place or another on the surface of the body is now quite well known.[4]

The reason for these curious locations is not quite like the misperceptions so far considered. The sensory tracts, it will be recalled, coming in from the surface of the body have their cell bodies in the ganglia just outside of the spinal cord. But it is also true that sensory tracts coming in to the cord from the various internal organs pass through those same root ganglia and there the excitations aroused by the internal organs actually stimulate the sensory tracts coming from the surface of the body. This results in the arousal of those perceptual patterns associated with that area of the body and

[4] Behan, R. J., *Pain, Its Origin, Condition, etc.*, New York, Appleton, 1920.

consequently the pain appears to be out on the surface of the body and not from the organ which actually gave rise to the excitation. When the internal organic sensory tracts coming into any root ganglion as well as the surface tracts are known, then the relationship between pains and the internal organs can be readily determined. This has been very largely done for purposes of medical diagnosis. They are frequently termed referred pains because they are "referred" through this mechanism to some associated body surface or area.

Time Perception. Just how and when the human awareness of time begins in the development of the individual is still an unsolved problem. It is customary to speak of time as a perception and that is probably correct for its more refined forms, but the origin of the consciousness of time, the basic awareness of temporality, may or may not be perceptual in nature. It may be as original and as unlearned as the experience of color or of sound qualities or of sweetness. Perhaps time is comparable to the original visual experience of pattern, partaking of the general nature of sensory behavior. Perhaps it is based in the nature of human physiology.[5]

But whatever be its basic or original nature it still remains clear that all of our experiences appear to change. Nothing continues exactly the same. From the awareness of this change we obtain the notion of pastness, of how something was before the change took place. And after many observations of the changes in some often-repeated experience there comes the notion of futurity. Observing a repetition of a change produces the experience of expectation. Hence the awareness of past and future, of before and after.[6] Children early acquire, doubtless through much help from their elders, the notion of before and after but larger extents and differences of time are of slower acquisition. The distinction

[5] Macleod, Robert B., and Roff, Merrill F., "An Experiment in Temporal Disorientation." *Acta Psychologica*, 1935, 1, 381-423.

[6] Dunlap, Knight, *Elements of Psychology*, chap. 6.

between forenoon and afternoon was placed in the Binet tests in the problems for the six-year age group. A full knowledge of time involving day of week, month of year and the number of the year appears in the Binet tests in the nine-year age group. It is also important to observe that even after the age of nine years perceptions of temporal terms continue to develop. To many a schoolboy a thousand years ago means very little. Perhaps also to many an adult. But, with the continued study of history and biology and astronomy, habits of thinking in terms of vast reaches of time become established and these habits acquire associations which give them meaning. The scientifically trained adult thus lives with time perceptions, in what might be called a time world, which are vastly greater than those of his boyhood.

Accuracy of the perception of specific time intervals is notoriously bad even for well-developed adults. Few persons can, unaided, judge a small interval, such as a minute, very accurately. The attempt to sit down with eyes closed and wait blankly until one minute "feels" to have passed results in gross illusions. But the introduction of counting, of observation of the pulse or the heart beat, or the tick of the clock, or of any aid known to be fairly regular, immediately improves the judgment of such small intervals of time. Such instances reveal how we ordinarily perceive the passage of time; it is perceived in terms of the events which happen in the interval. These may be such slight things as patterns of strain and relaxation of muscles and they may be far more significant external events.

In the ordinary affairs of life a period of time in which we are closely occupied, closely interested, seems to be much shorter than our time aids (clocks, watches, etc.) assure us that it is. Likewise a period of prolonged waiting with nothing interesting to do appears to be vastly longer than our timepieces indicate. By comparison, an interesting illusion often appears when we seek to recall such periods as those

just described. When we attempt to tell another about, or even to recall merely for ourselves, a particular period of time, which because of its interesting occupations seemed so short in passing, we find that in recall it appears to have been impossible for so much to have happened in that period. A busy week may thus seem in retrospect to be more like a month. On the other hand the hour which seemed like an eternity while we waited for a delayed train, with nothing to do, left little for recall except the fact that we waited an hour. In recall we get little notion of the apparent duration of that hour's wait. It does not seem so long in retrospect. But these illusions do not always take place. The housewife and mother working hard for the care of her home and children finds a year slip by very rapidly; and she also finds that in retrospect there is not much to recall because most of what had occupied her was just the regular routine of domestic responsibility which left few outstanding items for subsequent recall. Hence for her the year seemed to go fast and in recall seemed also to be a period of short duration. But the year which was filled with many dramatic episodes may easily produce the illusion of having been a very long year, when considered in retrospect.

Perception of Persons. Perceptions of persons begin very early and probably continue to grow and to change well on into mature years. Obviously the early infantile perceptions of persons must be very simple indeed. About all we know of them is that the child behaves in a manner which we term recognizing, the response to one person can be differentiated from the response to another. There is in these responses the beginning of those perceptions of persons which in time become so very complicated. The protective withdrawing reaction becomes linked with the sight of certain persons and the advancing acceptive reaction becomes associated with the sight of other persons.

Later in life after the person has been through much experience with people we can observe these same reactions to

persons, but vastly more complicated. Sometimes certain features of a person become isolated and the perceptual reactions appear to be aroused by the one feature out of what had once been a large pattern. These we refer to as trait perceptions. Of these there are many, and many of them quite false. The young man reacts to the perception of the light-haired girl with repugnance because he says that you can never trust a light-haired woman; the woman asserts that she can always tell if a man is honest or not by his facial expression; the one with a little more learning, but not enough, perceives the person with a long narrow head and light hair as a person of power and creative capacity. Of such perceptions as these there are many to be observed in the conversations and opinions of the general public. There are even commercial correspondence courses sold which claim to train persons in such perceptions—to be good judges of character. These help to build perceptions of traits in association with physical features and to encourage the long-standing but erroneous belief that such are scientific and reliable.

Some people, it is true, become very skillful in perceiving traits in persons, by having their reactions cued to certain physical features, or so they believe them to be. Systematic studies, however, have failed to demonstrate the alleged close relationship between physical features and character or personality traits.[7] The skill of these persons who do succeed in such trait perception of persons appears to be dependent upon other things than the simple physical features upon which they believe they rely. When they are asked to judge from still pictures, their judgments are not nearly so good. Apparently their guides in perception are facial expressions, especially those which involve the finer and more mobile muscles of the face, and to a considerable extent doubtless the muscles of the hands and arms and body. It is in movement and by movement that habits and attitude are expressed

[7] Paterson, D. G., *Physique and Intellect*, New York, Century, 1930.

rather than in the anatomical features. Photographs of persons in action register meaning far more effectively than do still pictures of the same persons.

Esthetic Perceptions. It is now becoming quite clear that so-called "art appreciation" depends upon the development of perception. Unless a person perceives in a musical composition the figures and patterns and organization there can be no evaluation of its excellence. Unless a person perceives the pattern and balance and rhythm in a picture there can be no possibility of judging how well the artist had achieved his purpose. Thus the teaching of appreciation becomes a matter of training the perceptions. Even in so simple a matter as the arranging of flowers, the child (or the adult for that matter) must be shown the features of flower arrangement, must have attention called to the essential items. If he is merely shown good arrangements and bad arrangements and told that one is good and the other bad, the differences may be observed and they may not—perceptions may be developed and they may not be. To develop the perception, effort must be directed toward bringing out in the response the awareness of the presence of those details which make for or against an attractive arrangement, an arrangement which people like.

An excellent example of this is to be observed in the reactions of young people to the cinema. Studies of their behavior revealed that many children respond with a sort of emotional orgy termed an "emotional possession." There is in such response an over-arousal of emotion and too little cerebral organization to keep it in control. To obviate this it seemed wise to develop more elaborate and detailed perceptions of the moving picture techniques. Consequently, a course was designed for high school students in which much was taught concerning the technique of photography in the movies, of casting, of directing, of lighting, of costuming, and so on. The consequence was the development in the young people of habits of perception in terms of the tech-

niques involved.[8] This led at once to evaluation in terms of these perceptions, in terms of good and bad photography, good and bad directing, good and bad casting, and the like. All this meant more cerebral organization and more control, hence less of the "emotional possession" which seemed so unhygienic. It is thus through training in the perception of artistic efforts and products that art appreciation is achieved. From such perceptions standards of judgment are established which influence the evaluation of products perceived.

Sometimes the perceptual response to an artistic presentation involves so much kinesthesis that the kinesthesis is clearly felt or the muscular activity may even become overt and obvious to an observer. This sort of kinesthetic response to a work of art is termed *empathy*. It literally means feeling into the object or situation. If, while looking at the Laocoön group, one feels a strain in his own muscles in harmony with those who struggle with the snakes in the statue, then one is experiencing empathy. In its milder degrees this probably functions quite extensively in our perceptions of works of art. Perhaps many will be better able to discover it in themselves in their responses to music than in their responses to the graphic and plastic arts, but with careful observation it may be found even there.

Language Perception. Almost anyone who has studied a foreign language in school can recall that the acquisition of language is the development of perceptual responses to the sight and sound of words and sentences. Words and sentences in the foreign tongue which at first look so very meaningless, especially if the letters also are different, gradually take on meaning, they gradually come to arouse responses similar to words and sentences of our so-called native language. But, obviously, our so-called native language is not something with which we were born but something into which we were born. We grew up in a world where our

[8] Dale, Edgar, *How to Appreciate Motion Pictures*. New York, Macmillan, 1933.

so-called native language was the method of communication and from our earliest weeks our ears were bombarded by its sounds and patterns of sound. We gradually learned that certain noises, words and groups of words, meant the coming of food or other pleasant experiences and responded accordingly; and we gradually learned that other sounds meant the coming of experiences far less desirable and pleasant.[9] And it is worth while observing that this building of perceptions for our own language goes on even in adult years. We continue to hear and see words which are unknown to us. By use of the dictionary and the observation of the use of these words by others we acquire perceptions for them ourselves. When we say that our vocabulary is large we really mean that we have effective perceptual reactions for a very large number of word sounds.

In reading, however, there is more involved than the mere perceiving of the meaning of one word and then the next. In the perception of spoken language there is, to be sure, more than the mere perception of each successive word, there are the perceptions associated with accents and emphases and inflections; but in the perception of the printed page there are also eye movements which are now known to be very important. When the eye moves, no useful sensory process is aroused in the retina. It is only in the moments of fixation that visual perceptions take place. Hence, in the reading of a line of ordinary type (as in this book, for example), the eye must move across that line in a series of fixations. Although several words are normally perceived at once the field of vision at any one moment of fixation is not very large. Therefore several fixations are necessary for the reading of a single line of type. While these movements of the eye do not probably contribute very much in the way of their own meaning to the perceptual reactions they are necessary in order that a proper sequence of perceptual responses may be

[9] We also learned to respond indifferently to many different pronunciations or combinations of these words.

aroused. The ordinary adult, it has been determined, makes five or six fixations with his eyes in moving across such a line of type as this. This degree of skill is reached by children in the fourth or fifth grade. But younger children and older ones who are slow readers make more fixations per line.

Very often, it has been found, they make regressive movements as well as forward movements. This means that instead of moving forward steadily across the line the eyes move forward a few jumps and then jump back to the approximate position of some former fixation. Such reading by many fixations including some that are in the reverse direction is much slower than it need be or, for adolescents and adults, should be. Much has been achieved in recent years to speed up the reading habits by training the reader into the elimination of the regressive movements and the reduction of the number of fixations.

So much of language perception is centered around vocal speech it is not surprising that we should tend to speak, even though very softly, while reading. Many of us learned to read by reading aloud. But it seems clear that this reading by the use of suppressed vocalization is also a slower method than may be necessary. Rapid readers have their language meanings aroused by the sight of the printed word or phrase and their perceptual response includes little if any of the speech pattern.

It should be unnecessary to add that, in addition to the speed of reading the actual words on a printed page, there must be the arousal of the meanings of the words and sentences if the reading is to be of any value at all. The effort to improve the speed of reading has sometimes run into the mistake of improving the speed of passing over or of merely uttering the words in order. Then came the discouraging discovery by tests of comprehension that the reader, although apparently now able to read more rapidly, was not comprehending what he read. Such training must therefore involve the arousal of a full perception with each fixation of the eyes

in order to have a comprehension of the material of the page.[10]

Synesthetic Perceptions. Sometimes the now familiar process of perceptual development is delayed or distorted in some fashion which results in rather unusual habits of perception—sufficiently different from the general run of people to raise comment and question. One of the most outstanding of these peculiarities is known technically as synesthesia. The perception of an object, it was shown above, involves the arousal of a pattern of formerly associated sensory responses which at the moment are not directly aroused, at least they are not aroused by the same stimuli as those which built up the perceptive pattern in the original experience. The perception of the location of a sound involved the arousal of tendencies to move in a certain direction and of visual images of objects in that direction. Often the response to a sound of a certain pattern and quality is the tendency to speak the name of a certain person. We thus know that a well-known person has spoken to us, although we may not have actually seen him. But in synesthetic perceptions there is the arousal of some association which does not appear in such perceptions in most persons. For example, a person has been reported who always had an experience of color aroused with each pitch in the tonal scale. It was possible for the person to paint the colors for each pitch. And when asked to repeat the painting a year afterwards showed surprisingly little variation.

There are also reports of persons who experience colors in response to voices, one person's voice is red and another yellow and so on. The same is true for names with some persons. Some synesthesias present an association of taste with audition, of pressure with cold stimulation, of color with pain, and so on through a long list of such combina-

[10] For a more extended presentation of the material on perception in reading, see Gates, A. I., *Interest and Ability in Reading*, New York, Macmillan, 1931.

tions. It is reported that these are of long duration and, as mentioned above, appear to change very little over considerable periods of time. They are also not reversible—stimulation in the other modality does not produce the reverse sensory combination.

The duration of these associations, as stated above, is commonly long, but it is also known that their frequency is somewhat less in adults than in adolescent years. Apparently, then, they do tend to disappear. But so do all other perceptual patterns endure for years and tend to disappear if they are not practiced. No one has indicated that these synesthesias are of any practical value. Hence, there would be no effort to utilize or cultivate them. That they change little over long periods of time is not strange in the field of perception. We have many long-unused perceptions which behave after a lapse of a year or more in a fashion which we cannot observe to be different in any significant detail from the former appearance of them. A book long unseen and unused or the name of a person long out of mind will arouse much the same perception after an interval of disuse.

So these synesthesias are thought to be perceptions in which some unusual association was established by the experience of childhood and then continue to appear long after the cause of that particular perceptual association has been forgotten. They are not abnormal, except as the unusual may sometimes be so designated, and they certainly do not indicate any kind of diseased condition.[11]

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[11] For other theories, of which there have been a number, and other details concerning synesthesia see Conklin, Edmund S., *Principles of Abnormal Psychology* (rev. ed., 1935), pp. 61-64.

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Chapter VIII

REMEMBERING AND FORGETTING

Definition of Memory. Memory, or remembering, is sometimes defined as the psychological function whereby we retain and recall those experiences, movements, or activities which are conditioned upon earlier experiences, movements, or activities of the organism. According to this definition, then, memory, or remembering, is operative in any behavior whatever in which there has been any previous experience. Thus, it is a term which applies not only to the more common and familiar aspects like committing to memory and retaining poetry, prose, music, mathematical proofs, names, dates, etc.; but it applies also to the recognition and recall of a face, a picture, an event, or any other object with which one has previously come in contact. Furthermore, according to the above definition, the term memory may be and in fact has been applied to such forms of behavior as swimming, riding a bicycle, skating, driving an automobile, and other activities involving bodily skills solely or primarily. But such completely unrestricted use of the term is confusing. It is better practice to regard swimming, riding a bicycle, etc., as bodily skills and to treat them and their acquisition and retention separately. Therefore, we shall use the term memory to designate the *acquisition and retention* of words, numbers, ideas, facts, events, and the like which leave an impression, so that they are retained in various degrees and subsequently recalled or recognized. Thus, we apply the terms memory and remembering, to those performances in which motor activity is not pronounced or primary.

Methods of Studying Memory. It should be noted that remembering includes two fundamental processes: namely, (1) the act of memorizing or acquiring, and (2) retaining what has been acquired. The first, memorizing, may be studied and measured in two ways: (1) in terms of how much of the material is acquired in a given length of time or after a given number of repetitions, and under specified conditions; and (2) the length of time or number of repetitions necessary to acquire the materials, under specified conditions. Retention, or recall, may be measured after intervals varying in length by finding what portion of the original materials can be (1) recognized, (2) reconstructed, (3) reproduced, and (4) anticipated. It may also be measured in terms of the time or number of repetitions necessary to re-memorize later. This last is the saving method.

Neural Basis of Memory. Memory is not an entity, force, faculty, or power which enables an individual to acquire and retain impressions. It is the function of acquiring, recalling, and recognizing, already referred to; and because it is a function, a process of behavior, an activity, an appropriate term is remembering. Memory undoubtedly has a neural basis.[1] This fact has been demonstrated in observations of aphasic and amnesic human subjects who have suffered serious brain injuries, as well as in cases of persons who are unable to recall the events of a relatively brief period just prior to physical shock resulting from a severe blow on the head.[2] The latter condition is called *retroactive amnesia*. The same fact has been established experimentally with animals. Lashley, for example, in experimenting with rats, destroyed different parts and different amounts of the animal's cortex.

[1] See, for example, Franz, S. I., "Studies in Re-Education: The Aphasias," *Journal of Comparative Psychology*, vol. 4, 1924, pp. 349-430; Lashley, K. S., "Basic Neural Mechanisms in Behavior," *Psychological Review*, vol. 37, 1930, pp. 1-20; also his *Brain Mechanisms and Intelligence*, Chicago, University of Chicago Press, 1930.

[2] *Aphasia* is a cerebral disorder consisting essentially of an inability to use articulated speech and to comprehend written or spoken words. *Amnesia* is partial or total inability to recall or identify past experiences.

He concluded that their loss of capacity to acquire the behavior demanded by the experiments (maze running) was roughly proportional to the amount of cortical destruction. He adds, further, that "A review of the literature on cerebral function in other mammals, including man, indicates that . . . the problems of cerebral function are not greatly different from those raised by experiments with the rat."

Memory and Learning. Learning depends in part upon the capacity to remember; upon the fact that the past is not lost to us but is preserved, more or less, in some form within our psychophysical organism. For after having once acquired certain materials, solved certain problems, or apprehended certain situations, our subsequent behavior in the same or similar situations is made easier. Remembering, then, enables us to make use of previous experience and behavior in dealing with new situations. Obviously, without the capacity to remember, every situation would be new, and the organism would have to begin from "scratch" in everything.

The effects of memory are manifested not only in specific recall and recognition. Memory may leave its *dispositional* after-effects. That is, in the course of behavior and consequent remembering, the organism becomes disposed to behave again in the same manner, and to feel and know what it previously felt and knew. In other words, the organism through its capacity to remember comes to retain more or less fixed ways of doing things and fixed ways of regarding things. This applies to such behavior as manner of talking; nature and extent of vocabulary; moral, political, and other attitudes; esthetic tastes; interests in various activities; purchase of a daily newspaper and other reading materials; and many others that could be named. In fact, a principal function of memory is to preserve the past in more or less well-defined ways of doing and regarding things. We hasten to add, however, that it is the function of *education* to keep these ways and attitudes sufficiently flexible to enable the

human organism to make necessary and suitable adjustments to changing or changed conditions.

We have stated that learning depends upon remembering; for without remembering progressive learning would be impossible, since such learning is dependent upon or facilitated by earlier acquisitions. But learning does not end there, for it involves reasoning, thinking, reorganization, and adjustments to new situations. Learning thus means an improvement and refinement of the organization of behavior. The mere recall or recognition of an earlier experience or behavior will not be sufficient to produce this improvement and refinement, since the situation of the moment may or may not have been encountered previously. Previous experience and remembering alone will not suffice to enable one to behave appropriately in every new situation. Learning, furthermore, may be characterized by *insight*, which signifies the rather sudden apprehension of meaning, without reference to specific previous experience, as evidenced by the organism's appropriateness of behavior. Thus in some situations specific recall or recognition is a necessary but not a sufficient condition for learning, whereas in others even recall and recognition of previous experience may be wanting.

When behavior consists only of doing, saying, thinking, believing, and otherwise acting as one did before, then it has become merely a matter of stereotyped repetition, and learning has ceased.

Memory in Young Children. · *Recognition* is the earliest form in which remembering manifests itself. Observers report that sometimes as early as the second month of life an infant responds differently to the voice and face of its mother than to those of strangers. The mother is greeted with a faint smile; to others it is indifferent. At the end of three months, the infant in its behavior differentiates more clearly; for it smiles and apparently shows pleasure on the appearance of its mother or other familiar persons, whereas it manifests

avoidance and displeasure with strangers. Thus, in the earliest months remembering appears as a recognition of the familiar and the strange. These recognitions, however, are limited to the few people and objects frequently seen. And this primitive form of remembering has only a very short latent period; that is, the traces of the infant's impressions will not long endure unless they are repeatedly renewed.

During the first year of life, the latent period (that is, the time elapsing between the experience and its recall or recognition) slowly increases, and the child's recognition of objects extends from a few persons to more and more of the objects in the situations of its daily environment: places, its food and toys, utensils, bath, crib, etc. During the second year, the latent period extends to several weeks; in the third year to several months; and in the fourth to as long as a year. Thus an increase in the latent period for recognition and in the number of objects recognized appears to be the most significant sign of memory development during the first several years of life. There are, of course, individual differences, some children developing more rapidly and others more slowly; but the latent periods given above are valid for the "average" child.[3]

It is reported, also, that beginning in the third year, the child shows evidences of recognizing objects and persons that have been experienced only a few times or even only once in the past. This is especially true of experiences which were colored by emotional unpleasantness, or by pain. Many observers, for example, have noted the strong negative reaction or aversion shown by a two- or three-year-old to a physician who previously had been associated only with a painful or unpleasant medical treatment. Experiences colored by very pleasurable emotions are similarly recognized; as with a particularly attractive toy the first impression of which was

[3] Cf. Hetzer, H., and Wislitzky, S., "Experimente über die Erwartung und Errinerung beim Kleinkind," *Zeitschrift für Psychologie*, vol. 118, 1930, pp. 128-41; and Stern, W., *Psychology of Early Childhood*, New York, Holt, 1930, *passim*.

received under especially pleasant circumstances. The ready recognition of a person or an object that was a member of a previous experience and behavior, either very pleasant or unpleasant, and the consequent restoration of the *total* previous situation, indicates a principle that is valid for all functioning of memory: namely, *persons, objects, ideas, etc., are experienced not in isolation but rather as members of a total situation; and such membership facilitates later recall and recognition.*

After the fourth year, there is a gradual development of the capacity for recognition, in terms of the number of items and length of the latent period; but this development does not show any new aspects. However, the subsequent years do show new features of remembering in other respects. Selective or controlled remembering develops; that is, *recall* of the numerous places, events, concepts, facts, methods, and the like, which become so essential in the activities of school children, adolescents, and adults. The individual, in selective remembering, is able, under proper conditions, to recall items and experiences which are appropriate and belong to the situation or whole which is being recalled. Without such capacity, behavior depending upon recall would be haphazard and unorganized. Memory would lack direction; we should be subject to an uncontrolled flood of associations.

With respect to recall in very young children, conclusive experimental evidence is not yet at hand. But a few experiments have revealed the relatively brief latency period of their recall, though it is not of the truly selective or volitional sort. Hunter reports the following.[4] A thirteen-months old child is seated within reach of three boxes, into one of which she observes a desirable toy being placed. But she is restrained from getting the toy. The problem is to see after how long a delay the child will still choose the correct box. It was found that the correct choice was made in 70

[4] Hunter, W. S., "The Delayed Reaction in a Child," *Psychological Review*, vol. 24, 1917, pp. 75-87.

percent of the attempts after periods of delay varying from eight to twelve *seconds*. A very short period of recall, indeed, even when compared with two-year-old children. Skalet [5] tested the period of recall in children between the ages of two and five and one-half years. A cookie was hidden under one of three plates, the act being observed by the child. The task was for the child to uncover the cookie on the first try, after varying periods of delay. It was found that the children responded correctly in 65 percent of their attempts after periods varying from one to three days. With longer periods of delay, the percentages of correct recall dropped. Older children, in general, and more intelligent children had longer periods of recall, as might be expected.

It should be noted that in these experiments recall was tested in the *same* situation where the first impressions had been received, thus suggesting the importance of the total situation to recall, at least in its early stages. It is doubtful if the ordinary child of these ages could have recalled the location of the hidden objects if the boxes or the plates, as the case may be, had been removed to another situation. It is even more doubtful if the child could have recalled the hidden objects merely through *verbalization;* that is, if he had been required to *state* or describe the location from memory. The exact rôle of verbalization in remembering during late childhood, adolescence, and adulthood is not entirely known; but there can be no doubt that it does operate significantly, enabling us to recall voluntarily and selectively without necessarily having to be physically present in the situation where the original experience took place. Our range of remembered experience and behavior is thereby considerably extended.

Factors Affecting Memory. It is well known that individuals differ in their ability to memorize and remember materials of all sorts. This fact is well illustrated by Figure

[5] Skalet, M., *The Significance of Delayed Reactions in Young Children,* Comparative Psychology Monographs, vol. 7, no. 4, 1931.

15, showing a distribution of memorizing score for 173 university students. The same type of curve is found with any kind of material used, provided the subjects of the experiment represent a good sampling, or cross-section, of the population being studied.

Differences in ability to memorize and retain materials are associated with the factors of age, sex, and general intelli-

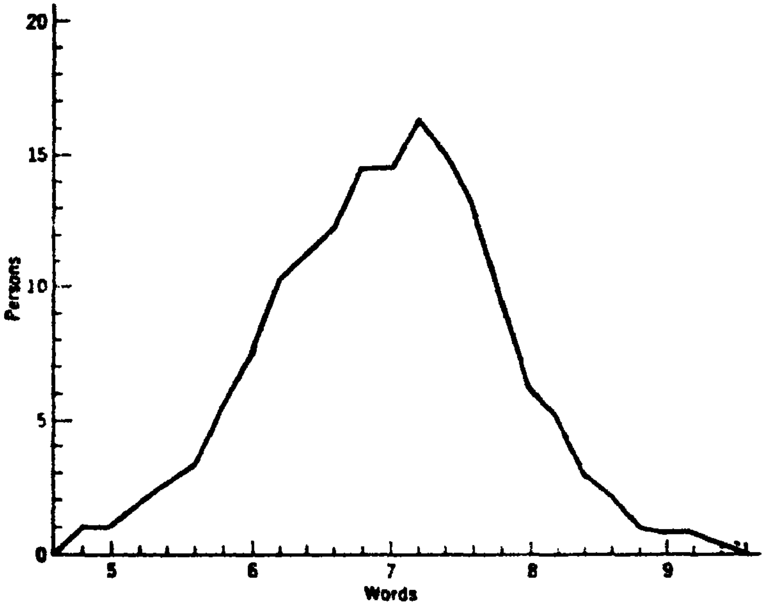


FIG. 15. Distribution of Memory Scores, 173 University Students. (From D. Starch, *Educational Psychology*, Macmillan Company. Reproduced by permission.)

gence; and it is our purpose to present briefly the relationships existing between these and memory.

Memory and Age. Ability to memorize and remember increases from early childhood to early adulthood or late adolescence, the exact age of cessation in growth differing somewhat with the materials memorized. Figure 16 demonstrates this fact with regard to ideational, or logical,[6] materi-

[6] There are two kinds of memory materials, *rote* and *logical*. In rote memory, original material is retained or recited *verbatim*, with no required attention to its meaning, although meaning of some kind may be and usually is

maintain their relative positions with respect to their age groups. And, in fact, older persons who in adolescence and early adulthood had superior memory capacity might still be and often are above the average of the general population, in spite of their losses due to increase in age.[8]

Memory and Sex. Although experimental results dealing with this topic are lacking in complete uniformity—and important exceptions will now and then be found, thereby making interpretation difficult, if not hazardous—the weight of evidence does justify certain moderate generalizations. In experiments dealing with memorizing and retention, females show a superiority over males, beginning with pre-school age and extending to the college period, although the group differences are relatively small and the *overlapping* of groups is great. Among very young children of pre-school and kindergarten age, girls as a group have been found superior to boys with such materials as digit span, recall or recognition of pictures and sentences. In the elementary and higher grades, girls as a group appeared superior to boys in drawing designs from memory, in digit span (both forward and backward repetition), in retention of concrete and abstract words, in retention of logical materials, and in recognition of nonsense syllables. When mature persons were used as subjects, it was found again that women surpassed men in immediate and delayed (one week or more) recall of materials such as short news items, facts of a college course, and details of advertising.

Unless it can be demonstrated that superiority of the female groups over the male groups in all these tests is due entirely or in large part to special training or to subjective factors of interest, incentive, sentiment, and the like, we must

[8] See also: Jones, H. E., Conrad, J. S., Horn, A., "Psychological Studies of Motion Pictures: II. Observation and Recall as a Function of Age," University of California Publications in Psychology, vol. 3, 1928, pp. 225-43; Humpstone, H. J., "Some Aspects of Memory Span: A Study in Associability," University of Pennsylvania Studies in Psychology and Pedagogy, vol. 8, 1917, pp. 1-31; Freeman, F. S., *Individual Differences*, New York, Holt, 1934, pp. 276-289.

conclude the capacities to memorize and retain are stronger in the former than in the latter. We must emphasize the fact, however, that although *group* differences favoring one sex have been found, the more important fact is that considerably greater differences are found between the various members of *each* sex, by comparison with which the group differences are relatively unimportant.

The problem of sex differences in memory is closely associated with that of language development. It appears that in language girls and women as a group develop more rapidly and are superior to boys and men as a group.[9] Now, that being the case, it is possible that female superiority and acceleration in language will account at least in part for the sex group differences in memory, since much of the memory material is verbal in character. It might be objected that the difference in language development will not explain girls' and women's group superiority in memory for non-verbal materials. But language facilitates memorizing, retention, and reproduction of even non-verbal materials, since these too can be verbalized.

Memory and Intelligence. Memory and intelligence are neither identical nor synonymous. Nor must the two be regarded as standing in opposition. It is true that there have been and probably now are cases of dull or actually mentally-deficient persons with "phenomenal" memories; but these are very rare exceptions whose unusual memory capacities can be explained by their remarkably clear imagery, auditory or visual. It is also true that sometimes persons of superior intelligence reveal poor or mediocre memories. Further, we sometimes find that persons of very good memory capacities—not "phenomenal," however—are of only mediocre intelligence. It would seem from the foregoing that there is no demonstrable relationship between the two: memory and intelligence. That is not the case. The preceding statements only emphasize the fact that in any *individual* instance,

[9] See Freeman, F. S., *op. cit.*, pp. 200-05.

the presence or absence of a certain capacity to memorize and retain need not imply a corresponding level of intelligence. There are inconsistencies in varying degrees, but *by and large for a group*, there is a demonstrable positive relationship between the two. This relationship is relatively low when the criterion of memory is rote material; but it is significantly higher when the criterion is logical materials.

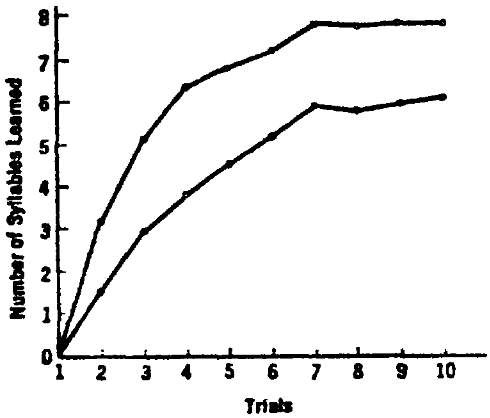


FIG. 17. Memorization curves of two groups of different average intelligence. (From E. S. Robinson and F. R. Robinson, *Readings in General Psychology*, University of Chicago Press.)

Figure 17 shows memorization curves of two groups of college students of appreciably different average intelligence. The materials used were nonsense syllables. It is obvious that the intellectually superior group memorizes more in a given amount of time than does the inferior group. Each point in each curve represents a group average. Individual exceptions, therefore, are not revealed. However, whatever individual exceptions (that is, inferior intelligence—superior memory, and *vice versa*) do exist are not sufficient to bring the curves together or make them overlap.

The relationship existing between the two—memory and intelligence—can be demonstrated statistically. Garrett [10] using

[10] Garrett, H. E., "The Relation of Tests of Memory and Learning to Each Other and to General Intelligence in a Highly Selected Adult Group," *Journal of Educational Psychology*, vol. 19, 1928, pp. 601-13.

materials of *rote* memory, found the following correlations [11] between the two factors: visual digit span, .18; auditory digit span, .21; visual paired associates, .23; auditory paired associates, .29. With logical memory materials, the correlation was .29. These correlations, though all positive, are low. They indicate that there is only a very moderate general tendency for the two factors to vary together.

The low correlation found with logical materials (.29) is surprising. In the first place, the fact that the subjects of the study were highly selected would in itself tend to reduce the correlation coefficient. And, second, it is not improbable that these memory materials were not sufficiently graded in difficulty. That is, the logical memory materials did not adequately *differentiate* between individuals of different ability levels. If that is the case, the correlation will be spuriously low. The following correlations suggest that this criticism might be valid, for they are significantly higher than those above.

Bolton [12] obtained coefficients with rote and logical materials and intelligence tests as follow: word recognition, .15; syllable recognition, .20; recall of words, .16; recall of dates, .38; recall of facts from a simple narrative, .55; recall of separate logical ideas, .54; recall of ideas logically connected, .63. These data show a definite and significant increase in the positive relationship as the memory materials involve the more complex relations of meaning. It will be observed that

[11] A coefficient of correlation is an index which may range from minus 1, through 0, to plus 1. It indicates the relationship of one trait, or measure, to another, the degree of relationship being shown by the size of the coefficient. A positive correlation indicates that a given amount of one trait *tends* to accompany a similar amount on the other, the strength of that tendency depending upon the size of the coefficient. A negative correlation indicates that a given amount in one *tends* to be accompanied by an opposite amount in the other. A zero correlation indicates there is no consistent relationship. A perfect correlation (+1 or —1) shows that a given measure in one trait is accompanied in the other trait by a measure which, relatively, is exactly the same (+1) or by one which is, relatively, exactly the opposite (—1).

[12] Bolton, E. B., "The Relation of Memory to Intelligence," *Journal of Experimental Psychology*, vol. 14, 1931, pp. 37-67.

the correlation with recall of dates is .38—much higher than with the other rote materials. But the reason very probably is that dates may be given a meaningful setting and may be associated with meaningful materials so that they do not exist in the relative isolation of a nonsense syllable, for example.

These and other studies establish the fact that intelligence and the capacities to memorize and retain are positively related, the relationship being low with rote materials but quite marked with meaningful. That is, the degree of relationship depends upon the nature and complexity of memory materials. The studies in this field show, also, that intelligence involves considerably more than merely the capacities to memorize and retain. The mere possession of information, therefore, is not to be identified with intelligence.

Distribution of Practice Periods. In the psychological study of memory, a large portion of time and effort has been spent on experiments intended to determine the best methods of memorizing. And naturally so: for an answer to this problem is valuable not only as a practical matter, but also in the theoretical interpretation of memory.

It has been clearly demonstrated that repetitions are more effective when they are distributed over a period of time than when they are concentrated or massed. Nonsense syllables [13] can be memorized with fewer repetitions and can be better retained, if the repetitions are spread over a few days than if undertaken at one sitting. This was first demonstrated by Ebbinghaus [14] who used nonsense syllables on himself as subject. At a given time, he memorized and then *overlearned* by a fixed amount, in immediate succession, six lists of 12 nonsense syllables each. The number of repetitions required was 410, or an average of 68.3 for each list. After

[13] Examples of nonsense syllables: mip, del, bof, bip, nam, kuv. They are syllables which are practically devoid of meaning.

[14] Ebbinghaus, H., *Über das Gedächtnis*, Leipzig, 1885. English translation by Ruger, H. A., and Bussenius, C. E., *Memory*, New York, Teachers College, Columbia University, 1913, pp. 60, 89.

twenty-four hours, he required an average of 6.8 repetitions to re-memorize the same lists in immediate succession. He later memorized lists of 12 syllables, one at a time, by practicing on three successive days, thereby reaching the same level of efficiency as above. The total number of repetitions, however, averaged only 38 for each list. Re-memorizing twenty-four hours later required an average of 6.2 repetitions. These self-inflicted experiments show more than Ebbinghaus's extreme patience: they reveal that by distributing practice periods, 38 repetitions sufficed to do the work of 68.3 massed repetitions.

Since Ebbinghaus's pioneering work, many other experiments have confirmed his results. Jost,[15] in 1897, likewise employed nonsense syllables, each of which was repeated 24 times. The lists retained best were those repeated twice a day over 12 days; next best were those repeated four times a day for six days; and poorest were those repeated eight times a day for three days. Perkins,[16] performing substantially the same experiment, confirmed Jost's findings, as shown by the following data.

	Percent Recalled After a Two-Week Interval
1 reading per day (16 days)	79
2 readings per day (8 days)	43
4 readings per day (4 days)	25
8 readings per day (2 days)	9

Numerous other subsequent experiments,[17] using a variety of materials and situations, performed with man and infrahuman animals, support the general principle indicated by

[15] Jost, A., "Die Assoziationsfestigkeit in ihrer Abhängigkeit von der Verteilung der Wiederholungen," *Zeitschrift für Psychologie und Sinnesphysiologie*, vol. 14, 1897, pp. 436-72.

[16] Perkins, N. L., "The Value of Distributed Repetitions in Rote Learning," *British Journal of Psychology*, vol. 7, 1914, pp. 253-61.

[17] For example, Lyon, D. O., "The Relation of Length of Material to Time Taken for Learning and the Optimum Distribution of Time," *Journal of Educational Psychology*, vol. 5, 1914, pp. 1-9, 85-91, 155-63; Austin, S. D. M., "A Study in Logical Memory," *American Journal of Psychology*, vol. 32, 1921, pp. 370-403.

the foregoing data. However, when *meaningful* materials are employed—instead of nonsense syllables and digits—neither method seems to enjoy a clear-cut advantage either in memorizing or in *immediate* recall. But in *delayed* recall when retention was measured, the method of distributed practice periods was definitely superior. This fact is of importance, because generally the chief purpose of memorizing is retention.

It is not possible to lay down a formula to be followed in distributing periods of memorizing and rest, or their length. These will depend upon the individual's age, interest, purpose, background, and the like; and upon the nature and length of the materials. The work and rest periods may be varied in many ways. But it can be said that some form of distribution is always superior to massed practices. As a psychological principle, that is by no means as precise and detailed as we should like to have it; but it still is very significant.

Several theories have been advanced to explain the superiority of distributed practice over the concentrated. According to one hypothesis, the neural processes involved in memorizing and retaining perseverate or continue active for a time after the practice, whereas the advantages of perseveration are lost through concentrated practices. This is at present only an hypothesis (and not universally accepted), for as yet but little is known regarding neural mechanisms of memorizing or of other complex psychological functions. As another explanation, it has been suggested by some that with massed repetitions the same errors are repeated more often, tend to become established, and must be overcome, resulting in a loss of efficiency in memorizing and of accuracy in recall. Still a third possibility is this: with continued repetitions, the subject loses interest, becomes less accurate, and is under tension to have done with the task. Under such conditions, any additional time spent in practice will be less effective than under favorable conditions. This third is known as

satiation. It is not the same as fatigue; nor does fatigue itself offer an explanation, for experiments in which fatigue has been controlled still show distribution of effort to be superior to concentration. In situations where satiation has been operative, the subject tries to get away from the task; he begins to introduce variations into his behavior; the task begins to disintegrate; the subject's attention wanders and he must force himself to return. Satiation, of course, would not be an important factor unless the task were monotonous or lacking in interest to the person involved. And this is the case with nonsense material.

Our discussion of distributed practice periods applies primarily to situations in which the *same* materials are gone over repeatedly in an effort to retain them verbatim or to retain their meanings and concepts. The discussion, however, does not necessarily apply to *continuity* of effort in which conditions vary, develop, or expand. These experimental results and their interpretation are not an argument, for example, for very short periods of work on any given subject in school with rapid shifts from one subject to another. The general learning situation in a school involves more than just memorization. But whenever memorization and retention are the primary or immediate purposes, distributed practices will be superior to the massed.

Part vs. Whole Method. The question is: if a person has to memorize a sequence of materials, such as a poem or a set of facts, or if he has to acquire the meanings and ideas of logical materials, is it more efficient for him to memorize them as a unit, or should the whole be broken into parts, the parts being memorized separately and then combined into the original unit? Efficiency of method is measured by the effort required to memorize the materials and by retention.

The answer to the foregoing question is, unfortunately, not entirely agreed upon by psychologists. But the weight of evidence is on the side of the whole method, when the

influence of other factors is ruled out. The members, or parts, of a single series or unit become more closely knit together in memory if the whole is reviewed at one sitting. It is true that the method of repeating the whole piece from beginning to end at one sitting is sometimes inapplicable. For example, it might be impossible for a child to give heed to and apprehend a poem of a dozen stanzas, whereas the same child could memorize the poem by taking one stanza at a time. The same might be true of an adolescent or adult in trying to acquire an elaborate and extensive set of principles. These exceptions, however, only prove the rule that in order to remember best, the materials must be grasped as a whole. The rule of memorizing by wholes simply states that *within the capacity of the individual* it is better to memorize by wholes than by parts. So far as children are concerned, they should not be expected to acquire longer or more extensive materials than they can master by complete repetition. Subsequent integration of parts into larger wholes is a very important aspect of learning; but breaking up a predetermined or logical whole into incomplete parts is pedagogically and psychologically unsound. Units should always be assigned as wholes. For children the units should be shorter and simpler, but still units.

An experiment by Pyle and Snyder[18] demonstrated the superiority, without exception, of memorizing poetry by wholes, the selections varying in length from five to 240 lines. For example, in passages of 20 lines, the time saved in memorizing was 12 percent; in 60 line passages, it was 22 percent; in 240 line passages, 19 percent. Many subsequent experiments since this one, using various kinds of materials and in different situations, have verified these findings; although it must be recognized that the results of some investigations are

[18] Pyle, W. H., and Snyder, J. C., "The Most Economical Unit for Committing to Memory," *Journal of Educational Psychology*, vol. 2, 1911, pp. 133-42. See also Brown, W., "Whole and Part Methods of Learning," *Journal of Educational Psychology*, vol. 15, 1924, pp. 229-33.

not favorable to the whole method.[19] But it will be found that even in these latter experiments a "pure part" method is rarely used. Instead, the large unit is divided into smaller units which can be compassed in one reading.

It appears to us that if other influencing factors are ruled out, or held constant, the part method will prove inferior. The problem is a very complex one, and it is not unlikely that its future study will deal with more restricted and more nearly analyzable aspects. Examples might be: (1) part and whole methods as related to intelligence; (2) as related to interest; (3) as related to established habits of memorizing. In fact, beginnings have already been made. Regarding the first of these factors—intelligence—one investigator concludes that intelligence affects the relative efficiency of the whole- and part-methods, in a comparison of gifted and mediocre children. This is what we should expect; since for the more intelligent person the unit of apprehension is greater, and he may therefore compass a wider range as a unit. Still another investigator has shown that the relative effectiveness of the whole- and part-methods is influenced by the person's interest in or attitude toward the materials; interest combined with the whole method being more effective than interest combined with the part method. However, *the particular method alone is not sufficient to compensate for the disadvantage of lack of interest or an unfavorable attitude;* for interest combined with the part-method is more effective than indifference or dislike combined with the whole-method.

Thus, an understanding of the mere mechanics of memorizing, though important, is not sufficient in analyzing the functioning of memory; although other things being equal, the mechanics will account for differences in economy of acquisition and amount of retention. We conclude that when

[19] See, for example, Reed, H. B., "Part and Whole Methods of Learning," *Journal of Educational Psychology*, vol. 15, 1924, pp. 107-15, 248-49; and Winch, W. H., "Should Poems Be Learnt by School-Children as 'Wholes' or in 'Parts'?", *British Journal of Psychology*, vol. 15, 1924, pp. 64-79.

the individual's subjective factors (interest, attitude, etc.), age, intelligence and previous training and habits are taken into account, the method of memorizing and learning by wholes is the sounder. The educational implications of this are clear: namely, the determination of the proper units of work in the light of individual capacities and needs.

An Active Attitude. The question to be considered under this heading presents, fortunately, no conflict of view or of experimental findings. The fact is that in memorizing or learning any materials it is desirable to take an active rather than a passive attitude. Memorization and learning are not achieved merely through a kind of "mental massaging." It is necessary that one do something about it himself. In trying to memorize anything, a person can merely *read* the materials over and over again, hoping it will "stick." Or he can spend varying portions of his study time in self-testing, articulating, or *reciting* the materials; that is, actively reproducing them. Reading is regarded as passive.

The following experimental data illustrate the point clearly.[20] About 250 school children from six grades were used. They memorized both nonsense syllables and the materials of very short biographical sketches such as are found in *Who's Who.* The entire group was divided into subgroups, each one of which spent different proportions of its

Percent of Time Spent in		*Scores* *			
		Nonsense Syllables		*Biographies*	
Reading	*Recitation*	*Immediate*	*Delayed*	*Immediate*	*Delayed*
100	0	65	48	88	80
80	20	92	85	95	96
60	40	100	93	105	127
40	60	105	119	105	131
20	80	137	115	106	129
10	90	...	...	100	121

* Average score is 100.

[20] Gates, A. I., *Recitation as a Factor in Memorizing,* Archives of Psychology, no. 40, 1917.

study time in reading and in recitation to one's self. Results were measured in terms of immediate recall and delayed recall of three or four hours. Typical relative results are shown on page 214, as found in grade 8. The results found in all other grades are consistent with those above.

Thus as regards both immediate and delayed recall recitation, in any proportion, combined with reading is superior to reading alone. Different materials and different individuals will no doubt show minor differences in the exact division of time; but it is doubtful if instances will be found where the optimum is less than 60 percent recitation or more than 40 percent reading. In establishing this principle for use with verbal materials—and most school materials, by far, are verbal—psychologists have simply produced evidence to show that, with respect to acquisition, these, basically, are not different from other materials. For example, the musician does not memorize his repertory merely by reading the scores: he plays them on his instrument. That is, in the process of memorizing, he goes through the same activity he will employ later in playing from memory. He also studies and actively explores (by analysis and comparison) his pieces away from his instrument.

We should note two other facts. First, recitation results in greater advantage in delayed recall than in immediate, although the latter is certainly appreciable. Second, in memorizing nonsense syllables, the advantage accruing from recitation is greater than in the case of the meaningful biographies. Since nonsense syllables are inherently meaningless and unfamiliar, these results suggest that the use of an active procedure will be especially effective with all new and unfamiliar materials: new and unfamiliar subjects, concepts, vocabularies, and the like. It is very probable that the advantages of recitation and other active procedures come from the opportunity to correct errors, to discover gaps and weaknesses, to present the materials in the same manner in which

they are to be reproduced later, and to draw attention to relationships, similarities, and differences.[21]

Accurate First Impressions. Since first impressions are the more lasting, it is important that the initial apprehension of and response to anything that is to be memorized or learned should be accurate. Thus the first presentation of new materials of study should emphasize those points or aspects which are most significant. Only such materials as the learner can grasp and remember should be presented; and, on the negative side, wrong or inappropriate impressions upon the memory which must later be dissociated or corrected should be avoided. This point is further elaborated in connection with learning.

Subjective Factors. Besides the mechanics of memorizing already discussed, there are several factors within the individual himself which facilitate or hinder memorizing and remembering. The individual must *intend* to acquire the materials, for without actual intention, the subject-matter does not "stick." Such was Ebbinghaus's experience, as it has been of most persons who try to memorize anything. Mere frequency of contact with or exposure to materials or situations will not necessarily result in acquisition, although at times there may be some incidental remembering. But at best, incidental memorizing is very ineffective. For example, students who have sat in a classroom many hours and have often looked through the windows are unable to state how many panes of glass each contains, unless they intentionally set out to ascertain the facts. The same may be said of the number of steps in a staircase, the details of a building often entered, etc., etc. This fact has been demonstrated experimentally.[22] Frequency of experience, combined with active

[21] See also Skaggs, E. B., Grossman, S., Krueger, Louise, and Krueger, W. C. F., *Further Studies of the Reading-Recitation Process in Learning*, Archives of Psychology, no. 114, 1930.

[22] Peterson, J., "The Effect of Attitude on Immediate and Delayed Reproduction. A Class Experiment," *Journal of Educational Psychology*, vol. 7, 1916, pp. 523-32.

observation of the things to be retained, intention to retain, and actual effort to apprehend meanings and relationships will be most effective.

The desire to remember is, in turn, associated with motives of behavior, interests, and emotions. In all situations involving memorizing and recall—in fact, in all learning—the subjective factors must be taken into account; for without them the interpretations of individual performances and experimental data are likely to be misleading and inadequate. In evaluating memory and learning, therefore, we must include not only the objectively controlled conditions of the situation—including the methods of memorizing—but subjective factors of influence—such as interest and emotion, intention and goal, knowledge of results and attendant feelings, which are among the most significant features of any method of memorizing.

The inclusion of meaningfulness and meaninglessness of materials as subjective factors is justified, since the same materials do not signify the same things for all, just as they do not interest all in the same degree. At any rate, the importance of meaning in the memorization of materials and the difficulty of trying to memorize meaningless materials arbitrarily chosen cannot be questioned, as the following data show. Ebbinghaus and Meumann—men of more than ordinary ability—required 55 and 33 repetitions, respectively, to memorize a series of 36 nonsense syllables. Yet the subjects of another experiment were able to memorize passages of poetry containing 60 *words* after 6 repetitions, 150 words after 15 repetitions, 300 words after 17 repetitions, 750 words after 19 repetitions, and 1500 words after 26 repetitions.[23] The economy of working with meaningful, readily organized wholes is apparent.

The meaningfulness of materials or of an experience sometimes depends upon its *functional* significance; that is, upon the part it plays in the individual's life. The Swazi culture,

[23] Lyon, D. O., *op. cit.*

for example, revolves around the possession and care of cattle. Cattle are the center of many of the most persistent and important social customs. Therefore, it was possible for a native Swazi herdsman to give a detailed and accurate description of all the cattle which a white owner had bought a year earlier, the native herdsman having been present during the transaction and having driven the cattle back to the white man's main farm. The native had no further experience with these cattle, for immediately afterwards they had been dispersed to different places, and the herdsman saw no more of them. Yet a year later he made but two minor errors when he gave all details of the transaction, including names of sellers, prices, and characteristics of each animal. This performance cannot be attributed to superior memories in general among the natives; for other tests have shown that such is not the case.[24] Thus, in the functioning of memory, the importance of significant experiences is apparent.

Forgetting. Thus far our discussion has been concerned principally with the nature of memory and the conditions of memorizing, with retention incidental. But forgetting (another way of stating retention) is just as much as aspect of memory as is memorizing. We wish to know the nature and rate of forgetting and what factors affect these.

Curves of Retention. The classical curve of retention was first given by Ebbinghaus, experimenting with nonsense syllables.[25] The curve shows that forgetting is very rapid during the first few hours, after which the rate of forgetting diminishes, until the loss is very slow indeed. In fact, the curve shows retention to be almost as good at the end of six days as at the end of two. The curve approaches the horizontal axis as a limit; but it is not known whether materials are ever completely forgotten.

The actual percents of loss were: after 20 *minutes*, 42 per-

[24] Bartlett, F. C., *Remembering*, Cambridge University Press, 1932, pp 249 f.

[25] *Op. cit.*

cent; after two *days*, 72 percent. These percentages must not be taken as representative of all materials and persons. The same general *type* or form of curve has been found in many later investigations in which materials other than nonsense syllables were employed; but the rates of loss are not necessarily identical, nor even nearly so. Meaningful materials, for example, are retained much better than meaning-

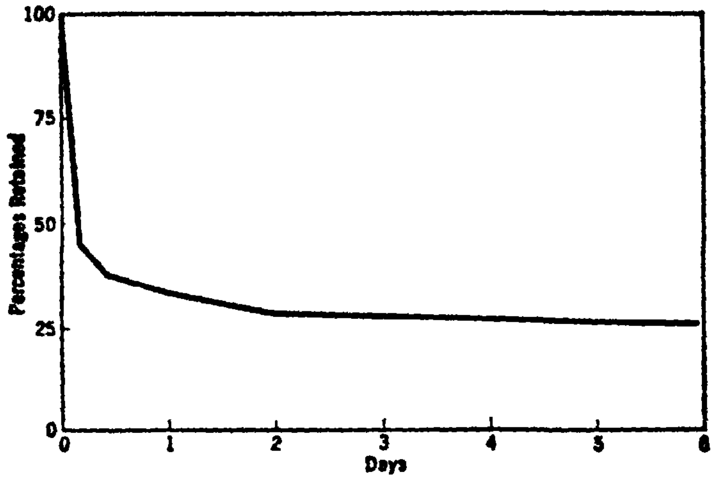


FIG. 18. The Ebbinghaus curve of retention.

less nonsense syllables, as well as being easier to memorize. Yet the *form* of the curve is the same in both instances, but in the case of meaningful materials, it drops more slowly.

There is an important exception to the Ebbinghaus curve. Ballard,[26] using poetry with his subjects, showed that in some instances, instead of an immediate loss in retention, there is an initial rise during the first day or two after memorizing. The curves of Figure 19 from a later study by Williams,[27] are of the same general form as those found by Ballard. This phenomenon—improvement without practice—Ballard named *reminiscence*. His results do not stand in isolation

[26] Ballard, P. B., *Oblivescence and Reminiscence*, British Journal of Psychology, Monograph Supplement, vol. 1, no. 2, 1913.

[27] Williams, O., "A Study of the Phenomenon of Reminiscence," *Journal of Experimental Psychology*, vol. 9, 1926, 368-87.

from and contradiction to all others, for other investigators have confirmed them. Reminiscence, therefore, must be regarded as a valid but special phenomenon of retention. Obviously, it will not be found where initial memorization has been perfect.

We must note several important facts in regard to Ballard's and Williams's studies. They used meaningful materials

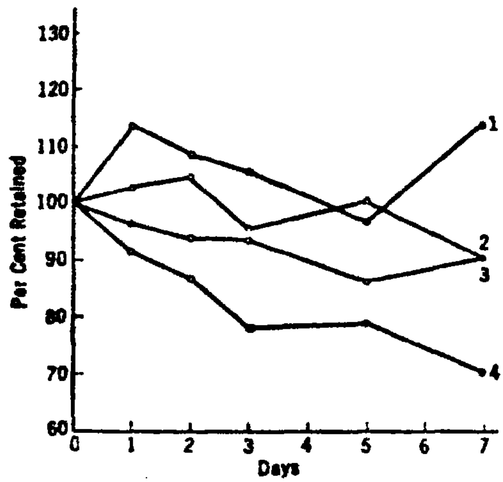


FIG. 19. Curve of retention for poetry. Curves 1, 2, 3, and 4 are for age groups 9+, 12+, 16+, and 21+, respectively. (From Williams, *op. cit.*)

rather than meaningless syllables. When materials are meaningful, they have a unity, organization, and inherent sequence absent from or only artificially and incompletely supplied to meaningless materials. This might be a condition of reminiscence. But the most significant and clear condition of reminiscence is age; for the phenomenon seems to be limited to younger children, as revealed in Ballard's curves as well as in Williams's. In the former's study, the maximum reproduction for six-year-old children was after three days; for twelve-year-olds it was after two days; for twenty-one-year-olds, immediately after study. Finally, reminiscence is not found in all children, even of the younger age-groups; but it is found in a large enough percentage and in sufficient

amounts to give the curves for younger children an initial upward trend.

An adequate explanation of reminiscence has not yet been developed. That, however, detracts nothing from the phenomenon's factual basis. Also, reminiscence does have several important implications with respect to several topics previously discussed. It suggests that experiences and behavior tend to perseverate more strongly in children than in adults. It supports the method of distributed study periods as opposed to the massed. It suggests that meaningful and properly apprehended units, or wholes, will perseverate better than the relatively meaningless.

Methods of Measuring Retention. Retention may be measured in five different ways: recognition, reconstruction, reproduction, anticipation, and amount of saving (in time or number of repetitions) in relearning. The first, recognition, is exactly what the name indicates: identifying parts as belonging to the originally memorized materials. In reconstruction, the parts are given the subject in disorganized form, and he must reconstruct the original sequence or unit. Reproduction and saving are self-evident. In the method of anticipation, the subject states, after the presentation of each part, what the following part should be. Figure 20 shows the differences in the percents recalled as measured by the several methods. The curves reveal several important facts. In the first place, they are all of the same general form as Ebbinghaus's classical curve. Second, they demonstrate that the special quantitative findings of different experiments will depend upon the method of measurement. Third, and very important, they disclose the fact that materials *apparently* forgotten are subject to recall under different conditions. Finally, these methods and their relative difficulty (excluding the saving method) have an important bearing upon examination methods at all educational levels. For example, since the true-false (or yes-no) and multiple-choice questions are essentially matters of recognition, they should be the "easiest"

for the student or pupil, from the viewpoint of testing for material retained. The usual essay type of examination, that is, written reproduction, should be much more difficult. Re-

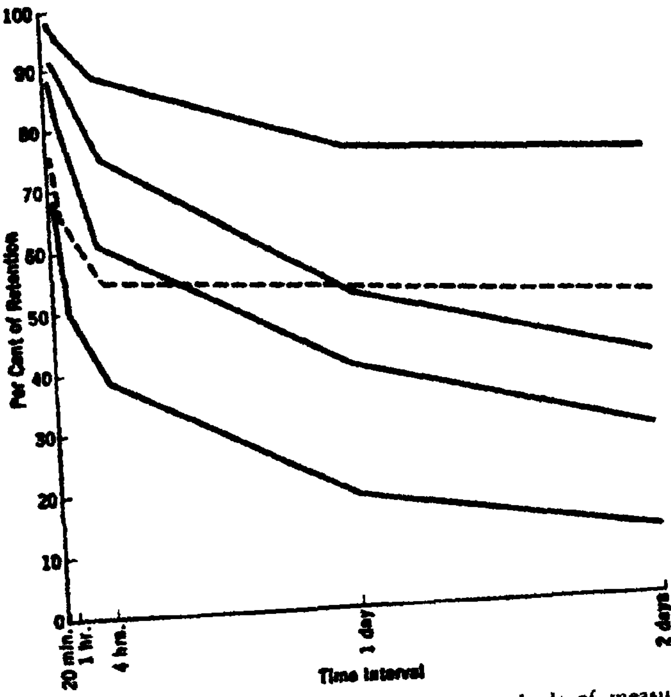


FIG. 20. Retention curves yielded by different methods of measurement. (From C. W. Luh, "The Conditions of Retention," *Psychol. Monograph*, XXXI, No. 142, 1922.) In descending order on the graph, the solid lines represent the methods of recognition, reconstruction, written reproduction, and anticipation; broken line represents relearning.

sults of this kind suggest the practical desirability of examining by varied methods.

Conditions of Forgetting. Forgetting is a universal phenomenon; but a complete or adequate explanation is by no means available. Still, we do know certain conditions which affect retention. One of these, the meaningfulness of materials, has already been mentioned earlier in this section.[28]

28 See also Bassett, S. J., *Retention of History in the Sixth, Seventh, and Eighth Grades with Special Reference to the Factors That Influence Retention*, Johns Hopkins Studies in Education, no. 12, 1928.

A second is *interpolated activity*. That is, between any behavior—including memorizing—and its later recall numerous other experiences and activities occur. This is inevitable, of course, unless recall takes place immediately following the behavior. These interpolated activities and materials tend to interfere with retention and recall of those that preceded. And interference appears to be greatest when the interpolated activity occurs just after memorizing and just before recall. The implied practical suggestion, therefore, is that memorization and study should be *followed* by a short rest period, and recall should be *preceded* by a rest period.

That interpolated activity is an important condition of forgetting has been shown by experiments on retention after equal intervals of waking and sleep, varying in length from one to eight hours.[29] Retention was very definitely better after eight hours of sleep than after the same period of waking time; after a four hour interval, there was still a significant difference in favor of sleep; after a two hour interval, a slight difference; and after a one hour interval, no difference. These results clearly point to interpolated activity as a primary condition in forgetting; and they lend support to the concept of perseveration as a principle of retention, since interpolated behaviors, according to the theory, would interfere with the perseverative process.

Another condition of recall is the affective or emotional quality which the materials have for the individual. That is, are they to him pleasant or unpleasant? In spite of several complicating factors—such as greater familiarity with the pleasant and unpleasant as opposed to the indifferent—the weight of evidence and the prevailing interpretation are on the side of better retention and recall of the pleasant, followed by the unpleasant and the indifferent, in that order.[30]

[29] See, for example, van Ormer, E. B., *Retention after Intervals of Sleep and Waking*, Archives of Psychology, no. 137, 1932.

[30] Meltzer, H., "The Present Status of Experimental Studies on the Relationship of Feeling to Memory," *Psychological Review*, vol. 37, 1930, pp. 124-39.

That is the order under formal and experimental conditions of memorizing and instruction. But the retentive potency of very unpleasant experiences under unusual conditions must be noted. While these are hardly a factor under formal conditions of instruction, they are nevertheless significant. For example, the difficulty or impossibility of shaking off a horrible sight, experienced only once, is a case in point.

It sometimes happens, however, that extremely unpleasant situations are recalled with the greatest of difficulty, if at all. They are *apparently* forgotten completely. Such instances are not the normal and usual evidences of ordinary forgetting. They are the results of a strong inner conflict in which the very unpleasant experience is debarred, so to speak, from memory. Repressed experiences and events can often be restored to memory under especially favorable conditions of recall, or in a state of hypnosis.[31]

Excepting instances of repression, then, forgetting as related to pleasant, unpleasant, and indifferent materials has an important implication for all educational situations, including formal schooling. Experiences, events, materials, etc., which are pleasant or unpleasant to an individual are of a sort that have a real and vital quality for him; that is, they appeal to and stimulate the basic wants, or motives, as these have developed in the course of his life-span. This does not mean that a full emotional expression should be provoked in a learning situation, for such is confusing and may be harmful and exhausting. It does mean, though, that the affective tone in a learning situation should be kept at a low tension of pleasantness or unpleasantness.

The environmental situation under which one attempts to reproduce previously acquired materials is another condition of recall. Everything one memorizes or learns takes place in

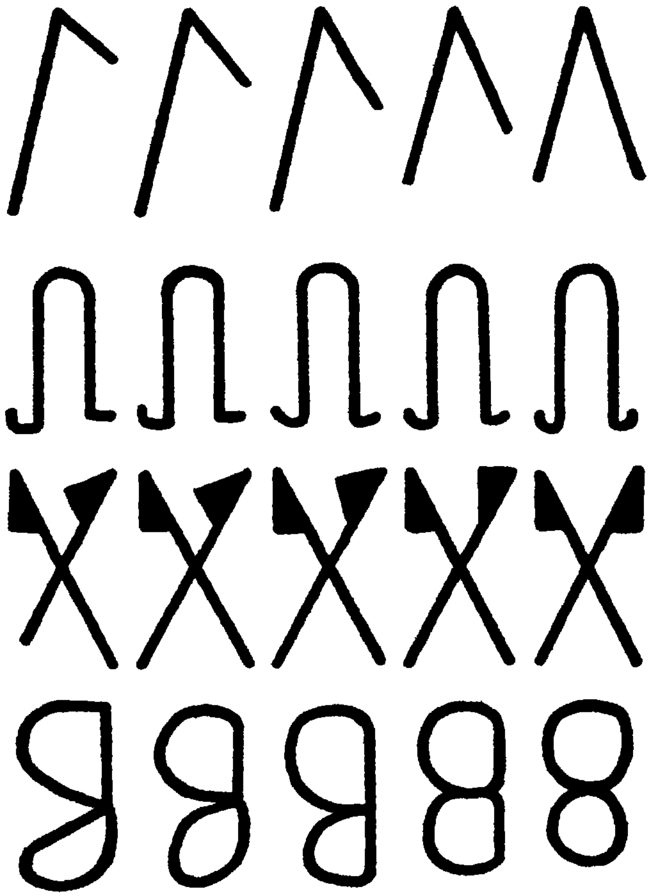
[31] Illustrative case studies can be found in almost any volume on abnormal behavior; e.g., McDougall, W., *Outline of Abnormal Psychology*, New York, Scribner, 1926, pp. 245 ff. The concept of repression originated with Freud.

a context, an external environmental situation. Whatever memorizing and learning occur take place in a given environmental context, and not in isolation. Recall, therefore, especially at first, is facilitated if it takes place under the same conditions and in the same situation where the materials were memorized. Of course, after materials have been frequently repeated and memorized well above the so-called psychological threshold, they can become independent of the original context in which they were acquired. It is a common experience that we work better, recall better and more accurately in familiar situations. Dress rehearsals in theater and opera illustrate the point. Furthermore, we all know that on returning to a scene from which we have long been absent we recall, often without effort, numerous facts and incidents that we have not "thought of" for years perhaps. The significance of this phenomenon is this: materials of memorization and learning do not exist in isolation and independence; they are at first members of and associated with a total-situation; and until they acquire independence of existence, their reinstatement in memory will be conditioned by the circumstances under which recall is attempted.

Distortions of Memory. With the lapse of time, we not only forget parts of materials memorized or events experienced, but the parts we do presumably recall undergo change, and we unknowingly fill gaps with items or parts that were not in the original. Distortions may occur in the reproduction of all types of materials. For example, successive reproductions of the same geometric figure will reveal constant change in a given direction. Figure 21 illustrates this fact, the changes being constantly toward the simpler, more familiar, and symmetrical.

With verbal materials, Bartlett has carried out some extremely interesting and significant experiments. We quote him at length because the phenomenon of distortion and his results are of great consequence not only for academic psy-

chology and the classroom, but for our daily lives, and especially in those situations where testimony plays an important



1 2 3 4 5

FIG. 21. Changes toward symmetry in the successive recalls of visual figures. (From F. T. Perkins, "Symmetry in Visual Recall," *American Journal of Psychology*, 1932. By permission.)

rôle—notably in courts of justice. Fallibility of human memory is striking. Bartlett states: [32]

In every single case, except that of cumulative stories, the final result, after comparatively few reproductions, would hardly ever be connected with the original by any person who had no access

[32] Bartlett, F. C., *op. cit.*, pp. 171, 175. By permission of The Macmillan Co.

to some intermediate version. There is little doubt that, with the ordinary free handling of material which is characteristic of daily life, much more elaboration takes place, though it is perhaps difficult to imagine that very much more startling changes could occur. The series . . . show a number of interesting and *constant* [italics ours] processes of change, all of which may be observed to occur as material is handed from group to group, or from person to person.

It is now perfectly clear that serial reproduction normally brings about startling and radical alterations in the material dealt with. Epithets are changed into their opposites; incidents and events are transposed; names and numbers rarely survive intact for more than a few reproductions; opinions and conclusions are reversed—nearly every possible variation seems as if it can take place, even in a relatively short series. At the same time, the subjects may be very well satisfied with their efforts, believing themselves to have passed on all important features with little or no change, and merely perhaps to have omitted unessential matters. A subject who takes part in an experiment is, as a rule, more careful than usual, and hence we may reasonably suppose that the changes effected by serial reproduction in the course of the social intercourse of daily life will probably occur yet more easily and be yet more striking than those which have been illustrated in the present tests.

Distortions in recall may be due to one or all of several factors. Certain details are *prepotent* for an individual; and in the course of reproduction these become more and more emphatic, while the less potent details tend to become less and less so or to drop out entirely. At other times, something in the situation which strikes an individual as queer or incomprehensible is unwittingly omitted or an explanation thereof is unwittingly introduced. In general, a person tends to report his experiences and fill the gaps of his observations in a manner he assumes to be suitable to the situation. And what he assumes to be suitable will depend upon what he has experienced before in similar situations. Thus, as Bartlett makes clear, a person in recalling and reproducing materials experienced in the past often falsifies or supplements the actual data, without being aware of doing so.

The significance of first impressions is further demonstrated in connection with distortion. We quote from Bartlett again (p. 176):

> It looks as if what is said to be reproduced is, far more generally than is commonly admitted, really a construction, serving to justify whatever impression may have been left by the original. It is this "impression," rarely defined with much exactitude, which most readily persists. So long as the details which can be built up around it are such that they would give it a reasonable setting, most of us are fairly content, and are apt to think that what we build we have literally retained.

Memory, therefore, is not a psychological function which exists and operates in isolation, but it is intimately associated with imagination, attitudes, and reflection.

Where it is necessary or desirable that recall be accurate, or essentially faithful to the original materials, the obvious remedies are two: first, correct initial impressions; and second, repeated and properly spaced contact with the materials so that distortions will not become established. For the methods employed in memorizing and recall will help to determine whether one's memory is to function faithfully in retaining and reproducing past experiences and behavior, or whether it will utilize these only as vague impressions fading and undergoing change in accordance with one's needs and attitudes.

REFERENCES FOR FURTHER STUDY

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Chapter IX

THE NATURE OF LEARNING

Learning Defined. We have already explained that learning and memory are not identical, although learning depends in part upon the latter. Memory, we have stated, enables us to utilize previous experiences and acquired knowledge in new situations; for otherwise each subsequent situation would be completely unfamiliar to us, and in every instance we should have to begin anew in our learning. But by learning we mean more than mere recall. Learning is defined as the process of developing the ability to respond adequately to a situation which may or may not have been previously encountered. Or, differently stated, learning is the process whereby behavior is improved and refined through adequate organization.

Learning, furthermore, may be characterized by *insight*, which is the apprehension of meaning and relationships with or without reference to specific previous experience. Insight is evidenced by the appropriateness and directness of the organism's behavior. Instances of insight occur when, for example, we suddenly catch on to the point of a joke, or to the principle of an explanation; or when we "see through" a problem being explained to us; or when we arrive at and understand the solution of a problem for ourselves. In other words, insight in learning implies reasoning, thinking, and reorganization of responses appropriate to new situations. Insight, to be sure, is something intangible, except as it becomes manifest in our behavior. But it is none the less an actual mode of behavior; it is something supplied by the learner himself, with or without assistance from the outside.

Without insight, learning would be no more than the recall of past experience and the mere assimilation of new experiences; it would lack its most important aspects: namely, reorganization of response and problem solving.

Learning also has another aspect and definition; it is the favorable modification of responses consequent upon previous experiences, particularly the building up of a new pattern of complexly co-ordinated motor responses. This really emphasizes the acquisition of skill, which will be discussed in the following chapter.

Habit, which is also a more or less complex pattern of response and relatively invariable—involving more or less motor activity—is the result of previous learning. As a product of learning and as a form of continuing behavior, it too will be dealt with in the next chapter.

Motives in Learning. In learning, the first essential is that the learner shall have a motive or an impulse to learn. There must be a felt need of change, improvement, solution of a problem, or overcoming of an obstacle. The individual desires, in effect, to achieve understanding and control of his environment. When such a need exists, it is said that the organism is in a state of psychological tension or disequilibrium; while his efforts to learn are directed toward the resolution of the tension and the restoration of psychological equilibrium.

Desire or felt need to learn rests basically upon the motives to behavior, already discussed. These are the springs of action and learning, modified and developed through maturation and experience. In short, learning proceeds basically from a felt need to do something, whether that need derives from the psychobiological motives of hunger, thirst, elimination, rest, and sex; or from the psychogenic behavior we have called curiosity, desire for approbation, and those which are social in character. In other words, the learning process is most effective when it is spontaneous and vital.

This principle is being applied in the education of young

children; in fact, *especially* before the beginning of regular school attendance. ". . . we wanted to stimulate the active inquiry of the children themselves, rather than to 'teach' them; and . . . we wanted to bring within their immediate experience every range of fact to which their interests reached out."[1] This was successfully done by providing an environment in which spontaneous activity, inquiry, and learning would flourish.

> . . the main character of our technique was to meet the spontaneous inquiries of the children, as they were shown day by day, and to give them the means of following these inquiries out in sustained and progressive action. So that the facts of their behavior with fire and water and ice, with pulleys and see-saw and pendulum, and (later) with drilling machine and Bunsen burner, can be taken as immediate evidence of the spontaneous direction of their interests. We did not "teach" our children about these things, nor try to create an interest in them, nor introduce any experiments or apparatus until the need for them had actually arisen.[2]

The importance and spontaneity of curiosity in learning are shown in children's questions concerning those aspects of their environments which are significant and interesting to them. The following are some questions reported by careful observers of child behavior and development: Who makes the sun? Who made the air? the earth? Where does stone come from? glass? wood? Who made the birds? Why won't it [wet raffia] burn? What makes them [plants] grow? Why are there beds on a boat [an ocean liner]? Why do we have to pick up things we put on the floor? Why can't the baby talk? What are the railway lines for? What are the two colors for [pointing to railway signal flags]?

These are but very few of innumerable examples that can be given relating to a great variety of objects, events, and processes. These and similar questions demonstrate that the

[1] Isaacs, S., *Intellectual Growth of Young Children*, New York, Harcourt, Brace, 1930, p. 17.
[2] *Ibid.*, p. 80.

extent to which they appear and are sustained, and the amount and kind of learning taking place will to an important degree depend upon the children's environment and upon the degree and kind of response the questions meet with in adults and older children. Obviously, without environmental objects, events, and processes, the necessary stimulation will be lacking; while without the encouragement and assistance of older children and adults, curiosity in the child will be checked.

The Goal in Learning. It has already been stated that learning must be motivated, the motive being, basically, one of the behavior potentialities as it undergoes development through maturation and experience. The *goal* of learning is related to motives; but it differs from motives in that it may be the *immediate* objective or purpose of a learning situation. Thus the goal of learning an aspect of arithmetic may be the mastery of certain arithmetical processes; but the motive might be the desire for approval through accomplishment, or the satisfaction of spontaneous curiosity.

The following illustrations are to the point. A white rat is placed in a maze containing many blind alleys, as well as a route leading to the exit which the animal must find for himself. Unlike most such instances, this rat is put in well fed, without a definite purpose, just to see what he will do. The animal need not seek the exit; nor does he do so; for there is no reason why he should. All he does is roam about exploring. Under these conditions, the maze is to the rat simply a place that allows motion and exploration. Later, however, this same rat is put into the maze when he is hungry and desires to reach food. His behavior is now markedly different from what it was on the occasions when he was satiated. Then, a blind alley was as good as a continuous path, but now it is not. Now he wishes to make progress, to get somewhere as directly as possible; and a blind alley is not as good as a continuation of the path that leads to the food chamber. Thus, modifications in the organism modify the character

and meaning of the objectively unchanged situation. While satiated, the rat found the maze a place to play in and explore. When hungry, he found it a very different thing: namely, an obstacle standing between him and food, to be overcome as quickly as possible.[3] The details of the animal's behavior, what he learns in the maze, and how quickly he learns it depend upon the goal and motive. The goal, or end to be attained, directs the activity.

The same principle is demonstrated by another experiment using chicks. The chicks first learned to reach the food chamber in a maze by running over a certain route, the best and shortest then available. Later a new opening was made, providing a short cut. Thereupon, the chicks took the new route.[4]

Motives and goals may be found in all learning. A group of college students were given rote tasks, such as writing a single letter over and over, canceling letters, and substituting letters for digits. Some of them were kept informed of their accomplishments by keeping scores of their mistakes, by assurance from the experimenter that they could improve, and by instructions to be on the alert for anything they might discover which would lead to improvement. The others had none of these advantages, with the result that they were far behind in rate, continuity, and total gain. Reversal of the groups in a new set of tasks showed analogous results.[5]

Another experiment will demonstrate how the goal affects learning in an actual school situation. Five different procedures were used with 951 pupils in grades 5, 7, and 9. For the first group of pupils, looking up the meanings of difficult words and the underlining of important items were made explicit and emphasized. The second group were to study

[3] Tolman, E. C., *Purposive Behavior in Animals and Men*, New York, Appleton-Century, 1932, pp. 343 ff.

[4] Aoki, S., "The Primary Principle of Animal Learning," *Jap. Journal of Psychology*, vol. 8, 1933, pp. 495-520; cited by Woodworth, R. S., *Psychology*, New York, Holt, 1934, p. 232.

[5] Book, W. F., and Lowell, L., "The Will to Learn," *Pedagogical Seminary*, 1922, vol. 29, pp. 305-362.

carefully selected questions on the materials. The third group were taught the meanings of difficult words appearing in the assignment. With the fourth group, the materials studied were related, so far as possible, to the pupil's personal experiences. To the fifth group, the causal relationships within the materials were explained. The results indicated a consistency of gain in accomplishment, the type of gain being correlated with the type of goal or assignment set up for each group by the experimenter.[6]

The clear and important implication of these and similar experiments is that the motive and goal of the activity help to define the nature of the situation. The individual takes a "set" with respect to the situation and the materials to be learned. He selects those aspects of the situation or materials which are in accord with his purpose. It is essential, therefore, if learning is to be facilitated, that the educator take into account the maturity (which helps determine motives and interests) and mental equipment (which determines perception of goals) of the learner, on the one hand, and the organization and presentation of the materials, on the other.

Insight in Learning. The degree to which a learning situation is valuable and meaningful depends in part upon the degree to which the individual is prepared for and anticipates the significance and meanings of the situation. This is foresight. But there is also *insight,* which means perception of the parts that constitute the whole situation and perception of the relations of these parts. It means proceeding intelligently rather than blindly or mechanically. This is the use of the term "insight" in its common-sense meaning. For example,[7]

If one knows that he is to remove a ring in a certain puzzle, and that in order to do so he must first move this piece and then

[6] Jordan, A. M., "Influence of the Assignment on Learning," *Journal of Educational Psychology,* vol. 22, 1931, pp. 659-666.

[7] Koffka, K., *The Growth of the Mind,* New York, Harcourt, Brace, 1928 p. 197.

that, and then turn the puzzle over and do something else, his procedure may be said to possess a greater degree of insight than the procedure of another person who simply goes ahead without any plan at all. But if one also knows that the ring is connected in such and such a manner with such and such parts of the device, and these are again to be turned thus and so, his procedure will indicate a still greater insight.

The principle here stated applies equally well to learning when and how to use mathematical devices and procedures, and grammatical forms; to the apprehension of scientific materials; indeed to the understanding and evaluation of all knowledge and skills.

The rôle of insight in learning is well demonstrated by Köhler's experiments with apes.[8] Apes are especially good subjects, for, as Koffka states,[9]

Can experiments be so planned that the animal's behavior will show insight without the aid of chance discovery? When we consider what this means, it at once becomes clear that both animals and children are well-adapted to such experiments. Adults, on the contrary, are not suitable subjects, because they bring to their tasks a set of ready-made methods which need only be transferred to the new situation; but how these ready-made methods originated it is not at all easy to determine. If, on the other hand, the problem selected makes such a transfer impossible, it is hard to find a suitable test; for usually a task of this order is far too difficult for an experiment. Hence the study of insight in its incipient forms can best be undertaken with children and animals.

The essential features of Köhler's experiments are: (1) the animal must employ a roundabout method, or he must use rather novel implements in the solution of the problem; and (2) the situation can, potentially, be wholly surveyed by the animal and can be grasped by him. That is to say, the situation presents a problem whose solution demands the utilization and reorganization, and sometimes the transformation

[8] Köhler, W., *The Mentality of Apes*, New York, Harcourt, Brace, 1927.
[9] *Op. cit.*, p. 198.

of items within the range of the animal's intelligence. What is demanded of the animal is an arrangement of things into their proper places and relationships on a perceptual level. Several illustrative experiments follow.

The chimpanzee was sitting close to the bars of the cage, opposite the goal (banana) which was placed outside beyond his reach (Fig. 22). In the animal's hands was a stick which, however, was too short to enable him to obtain the fruit. Outside and parallel with the bars, and about six feet to one

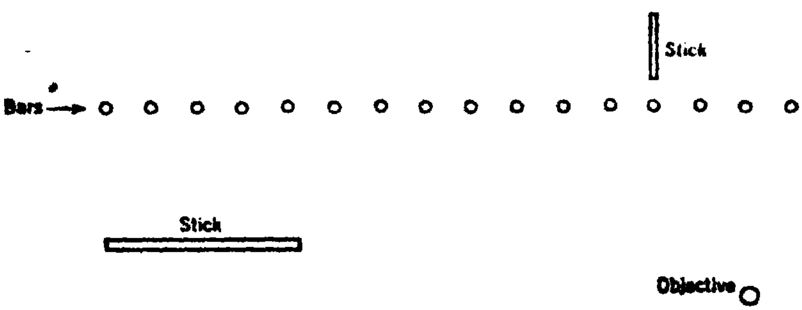

FIG. 22. (From W. Kohler, *The Mentality of Apes*, Harcourt, Brace.)

side of the fruit, but lying nearer the bars, was placed a longer stick which could be reached with the aid of the shorter stick. The ape tried to reach the fruit with the aid of the shorter stick but failed, of course. The animal then gazed about him, scrutinizing the situation. Suddenly, he picked up the short stick, pulled in the longer one with it, then used the longer stick to haul in the banana. The two sticks had fallen together in his line of vision, whereupon the situation was suddenly altered and the problem solved. The animal had learned in one successful trial. In summarizing this experiment, Köhler states: [10]

> From the moment that his eye fell on the long stick his procedure forms one continuous whole, without hiatus, and, although the angling of the bigger stick by means of the smaller is an action that *could* be complete and distinct in itself, yet the observation shows that it follows, quite suddenly, on an interval

[10] Köhler, *op. cit.*, p. 174.

of hesitation and doubt—staring about—which undoubtedly has a relation to the final objective [obtaining the fruit] and is immediately merged in the final action of the attainment of this end goal.

In another of Köhler's experiments,[11] neither of two bamboo sticks in the ape's hands was long enough to reach the fruit outside the cage; but if the two sticks were fitted together by placing the smaller one into the hollow core of the other, they would provide the necessary length. Several errors were committed in attempts to solve the problem. The solution came, however, when the ape by chance got the two sticks into line and slipped the smaller stick into the bore of the larger one. Although he was, at that time, sitting idly on a box with his back half turned to the fruit, he sprang at once towards the bars of the cage and pulled in the fruit. Here again is an instance of learning with insight; here was a new situation which called for a new order of behavior. One successful solution of the problem was sufficient to establish the act; there was no repetition of unsuccessful or partially successful trials.

Numerous behavior forms of young children also exemplify insight. We quote only two instances from many careful observations.[12]

Benjie (4 years of age) and Christopher (4 years and 1 month) wanted to drag some large logs of wood from one side of the garden to the other; they took walking sticks and hooked them into projecting branches on the logs, and dragged them, with much pride.

Phineas (4 years of age) wanted water for his garden, and there was some in the leaky barrow. He put a pail under the barrow, and asked Miss C. to "make it run through." She said, "How?" "Tip it," he replied. He watched it with great delight, saying, "See the water running." Miss C. said, "The barrow's too heavy to hold." He brought a brick and fixed it under the wheel, so as to keep the barrow tipped. But not all the water ran out, so

[11] *Op. cit.*, p. 126.
[12] Isaacs, S., *op. cit.*, pp. 121 and 129.

he said, "Tip it some more," and brought a second brick to hold it at a sharper angle. When Miss C. raised it high, he said, "Be careful, don't tip it right over."

The two foregoing instances occurred in situations where the children, though observed, had a considerable degree of latitude in their activity. The situations were not of the arranged laboratory type. But also in the latter, the rôle of insight is equally apparent.

One investigator, using with 44 subjects the methods outlined by Köhler in his *The Mentality of Apes,* adapted a variety of situations to children ranging in age from 19 to 44 months.[13] Although the details of the experiments differed from those of Köhler's—as, for example, when toys were substituted for bananas and oranges—the plan and form of both sets of experiments were the same, each presenting a problem to be solved by using tools or other aids available in the situation, if perceived. The author of this study with children concludes that, "No matter what the type of response, it culminates in a solution only if the subject has gained insight into the problem-situation." Furthermore, she concludes, also consistently with Köhler and our preceding discussion, that solution of a problem is not achieved merely through the operations of chance. What chance may do is to facilitate insight by bringing the elements or parts of a situation into a fortunate or "suggestive constellation." The prospective learner must perceive the situation as a whole and continuously give heed to it.

Finally, we cite one experiment showing the rôle of insight in adult learning.[14] Three groups of number series were arranged, as shown on page 239, not in their entirety, but sufficient to reveal the principles involved. It is apparent that the *X* column has no plan or formal progression.

[13] Alpert, Augusta, *The Solving of Problem Situations by Pre-School Children,* Contributions to Education, Teachers College, Columbia University, no. 323, 1928.

[14] Guilford, J. P., "The Role of Form in Learning," *Journal of Experimental Psychology,* vol 10, 1927, pp. 415-23

X	Y	Z
3	6	8
4	7	7
8	9	9
11	12	6
20	16	10
25	21	5
30	27	11
33	34	4

The *Y* and *Z* columns, on the other hand, are arranged according to definite, though different, forms or progressions. The *X* and *Y* series were presented alternately to the subjects with instructions to learn these as quickly as they could. After each repetition, the list was reproduced so far as possible. The subjects were instructed to learn the *Z* series, but also to look for the form in so doing.

The question we are concerned with here is whether the emergence or discovery of a form or plan facilitates learning. The answer is definitely in the affirmative. The *Y* series was learned after an average of 1.4 repetitions, whereas the *X* series (without form) required an average of 3.2 repetitions. In the *Z* series, when the form failed to emerge for the learner, the average number of repetitions required was 4.25; but when the form, or plan, was perceived the average was only 1.4 repetitions—about one-third as many.

When we speak here of perceiving the form, or plan, or progression, we are referring to insight. In other words, acquiring these lists of numbers with insight means that learning them is no longer a matter of sheer mechanical memory, but that the logical relationships (the form or pattern) have been discerned. That being the case, the learner could forget one or more members of the series but yet complete the series correctly; for discernment of the pattern of organization will enable him to supply the missing parts. The *X* series, on the contrary, has to be acquired by sheer memorizing, for there is no pattern or form to give it meaning. It has

also been shown that college students, after a fifteen month period, remember only about twenty-five percent of the information items of a course; but their ability to interpret data suffers no loss after the same period.

Educational Significance of Insight. A learning- or problem-situation should be pitched at the level of the intended learner's insight. The same individual will attack a problem in an aimless, trial and error manner, or in a manner of orderly and deliberate exploration and elimination, depending upon the set-up of the situation or problem, and upon whether or not it is within range of his abilities. In the first instance, if a solution is achieved, it will be the result largely of chance, which may or may not effect improvement in later situations of a similar kind. In the second instance, the solution results from organization and discernment; the effects will be lasting.

Materials which are meaningless, that is, do not provide opportunity for insight for the intended learner, or which are nearly so, require more time and effort than do the meaningful. Conversely, materials whose meaning and organization are grasped by the learner are acquired most readily and last longer. The practical significance of this is that organization, pattern, form, or meaning of what is to be learned should at the very beginning be made as explicit as possible. The situation or the problem and the steps in its solution must be clearly defined and ordered, or sufficiently so, that the learner may complete the organization by bringing the elements together, as the apes did in the experiments already cited. The purpose of the act must first be understood and desired in terms that are consistent with the motives and ability of the learner. Even in copying a single letter, the child must at least have some perception of right and left and up and down, for otherwise all parts of the act will remain an undifferentiated blur. The same principle is valid in adult achievement. Even a good artist, for example, will be unable to portray dancers effectively unless

he had first studied dance routines, steps, and figures. Otherwise, he would not know where to begin and what to emphasize. In any performance, it may be generalized, the degree of success will depend upon the adequacy of insight.

The importance, therefore, of appropriate units of study, of lesson plans for pupils and teachers, of adjusted curricula—all of which are a recognition of different levels of insight and ability—becomes apparent at once.

It is the emergence or achievement of new relationships as a result of developing insight that is the quintessence of learning. Achievements of this kind are the means by which the progressively complex organism gears itself to the environment.

Maturation and Experience in Learning. In the chapter on "Original Behavior" we discussed the rôles of maturation and experience as they relate to concepts of original or "instinctive" behavior. It was shown that both maturation and experience co-operate in the learning of walking, climbing, and talking, for example. Exactly the same principle applies throughout all forms and levels of learning.

Beginning with infrahuman animals, for example, it has been found that chicks deprived of all opportunity to peck for forty-eight hours after hatching, upon being given an opportunity, pecked much more effectively and adequately than did the unrestrained chicks immediately upon hatching.[15] After a while both sets of chicks came abreast. This, clearly, is evidence of organic and behavioral maturation quite aside from practice. On the other hand, when a number of new-born chicks were deprived of all opportunity to peck for a period of two weeks, they did not develop their pecking behavior at all and would have starved in the presence of food. It was necessary to feed them artificially.[16]

[15] Bird, C., "The Effect of Maturation upon the Pecking Instinct of Chicks," *Pedagogical Seminary*, vol. 32, 1925, pp. 69-91; also vol. 33, 1926, pp. 212-243.

[16] Cited in Wheeler, R. H., and Perkins, F. H., *Principles of Mental Development*, New York, Crowell, 1932, p. 243.

Thus, maturation alone is not enough; it is necessary to provide opportunities to function; that is, to learn. For without such opportunity at the optimal period the effects of maturation may be lost in whole or in part.

It is an established fact, of course, that there are marked differences in mental operations between average individuals, say, two, five, ten, or fifteen years of age. These differences are due in part to differences in degree of maturation and in part to differences in experience; for as a person lives longer he not only matures organically, until the maximum is reached, but he accumulates more and wider experiences. Yet experience without an appropriate level of mental maturation will be of little or no value. For instance, a child cannot learn, nor can we teach him the concept of "opposites" until he is ready for it. No amount of repetition and illustrations will give the ordinary three- or four-year-old child insight into that concept; whereas when the child is ready, several examples, within the range of his apprehension, will suffice to have him learn the concept permanently. A second example is found in children's notions and definitions of objects and events. If we ask a child of six or seven years, "What is a chair," or "What is a knife," the ordinary replies are, "A chair is to sit on"; "A knife is to cut with." At nine or ten, in response to these and similar questions, the answers will be in terms of general characteristics; the definitions describe and classify. But ordinarily not until the age of about fourteen is the individual able to deal with abstract terms and their definitions, such as "charity" and "justice."

Another illustration is found in learning to read. Educators and psychologists now speak of "reading readiness." This term refers simply to the question of whether the child is prepared to receive reading instruction, a major factor in that readiness being maturation. The ordinary child is ready to begin the learning of reading—that is, he has the ability and the felt need—between the ages of six and seven.

Some are ready at five; others not until eight, or even later. These are matters of individual differences, since, as we shall see, rates of mental development are not uniform among all children; nor are the levels of maximum development.

The rôle of development is apparent also in problems requiring reasoning. In the Burt Reasoning Test, for instance, we find the following problem at the seven-year level: "Kate is cleverer than May. May is cleverer than Jane. Who is the cleverest, Jane, Kate, or May." On the same test, at the age of twelve the ordinary child is supposed to be able to deal with the more complex problem and spatial relations involved in the following: "I started from church and walked 100 yards. I turned right and walked 50 yards. I turned to the right again and walked 100 yards. How far am I from church?" At the age of fourteen, according to the Burt test, the ordinary individual should be able to reason at the level of complexity represented by the following problem: "John said: 'I heard my clock strike yesterday ten minutes before the first gun fired. I did not count the strokes, but I am sure it struck more than once, and I think it struck an odd number.' John was out all the morning from the earliest hours; and his clock stopped at five to five the same afternoon. When do you think the first gun fired?"

The important point here is not so much the exact age at which each of these and similar problems can be solved; it is rather the sequence or progression in ability to organize and deal with larger wholes whose parts are not only greater in number, but in which the relationships of the parts are more involved and more subtle.

Further, the rôle of maturation in development is shown by the fact that though progressive changes, such as those illustrated above, take place over a period of years, they do come to an end and at the age of maximum mental capacity, whether that be 14, 16, or 20 (see p. 507). Thereafter, experience can be added to; new information can be acquired; increased familiarity with fields of knowledge can bring

greater effectiveness. But after the age of maximum growth, more effective learning, increased wisdom, and improved judgment are not a consequence of actual increase in sheer learning capacity. They are attributable to greater and wider experience, stronger incentives, greater seriousness of purpose, and the like.

In connection with the subject of maturation, it is necessary to caution the student against any assumption that mental growth, and therefore learning, proceeds in well-defined periods or segments. In the past, it was held that mental development and learning proceed in a series of well-defined phases, or "layers." It was supposed that first came sense perception and that there was nothing much more to the infant's and young child's mental processes. Then, it was supposed, came motor development; later, memory; and still later, reasoning, thinking, and judgment.

This notion has been rejected by psychologists for several very important reasons, derived from experiment and observation. Mental operations are essentially unitary, involving in any situation many or all of the processes mentioned above. The sensory perceptions of young children are developing and becoming more acute. But, at the same time, young children are capable of remembering and reasoning; while thinking and judging develop concomitantly. Reports and observations of children's activities make this abundantly clear.[17] Curves of mental growth lend further support in showing that mental functions, or processes, generally grow continuously and regularly until the maximum level is attained, although there are individual exceptions whose curves are not smooth and unbroken. Yet even these exceptions exhibit *concomitant* development of functions which are schematized separately but are different aspects of the same general mental processes. New functions do not

[17] For actual verbatim examples, see, for instance, Isaacs, S., *op. cit.*, pp. 111-158; also, Piaget, J., *Judgment and Reasoning in the Child*, New York, Harcourt, Brace, 1926.

suddenly appear when an individual reaches a given age. What does occur is a more complex, subtle, and broader organization in these mental processes. Furthermore, as we shall note in a later chapter, the inter-correlations between various mental processes and activities are quite significant. In brief, there is considerable overlapping of mental functions at any period in development, even though the several functions develop at different rates and are at different levels of their development at a given age. For example, visual acuity continues to improve until about 13 years of age, whereas memory grows until the age of about 25.

Four Ways of Learning. There appears to be a general principle of behavioral development, whether it be in spontaneous motor activity or in perceptual learning. The principle is this: diffuse or mass activity is the earliest kind of behavior to manifest itself, while the more specific and precise responses later differentiate, or emerge, from this mass activity. For example, in the infant, grasping proceeds to develop from the coarser muscles of the shoulder and upper arm to the finer muscles of the wrist, thumb, and forefinger. This is an instance of *progressive differentiation* and increase in precision. This phenomenon is to be explained by the anatomical growth of the infant's hand and digits, by increasing cutaneous sensitivity of the finger tips, by neuromuscular maturation, and by training.[18] We shall have occasion to deal with this matter again, as regards motor activity, when we consider the topic of skill and its development.

The acquisition of knowledge depends upon a *process* of development which is essentially the same as in the development of grasping; that is, it depends upon a person's ability to increase his discernment of certain aspects of the situation as being more or less defined and distinguished from the

[18] See Halverson, H. M., *An Experimental Study of Prehension in Infants by Means of Systematic Cinema Records*, Genetic Psychology Monographs, vol. 10, nos. 2 and 3, 1931.

rest of the situation. In other words, some features will stand out more as development progresses, whereas others may not be discerned at all, simply remaining fused, so far as perception and knowledge are concerned.

For instance, an infant early learns to distinguish its mother's face from all other faces, by virtue of a variety of contexts in which the mother's face has been seen by the child, contexts generally of a pleasant character. But the mother's face is discerned as a whole; it is not seen as an aggregate of distinct eyes, ears, nose, mouth, etc. It is the totality of that face that distinguishes it from all others; and it is doubtful if the infant then is even aware of the component parts. Even after the child discerns the facial members, his perception of a "friendly" or an "unfriendly" face may be quite different from an adult's perception of the same face. The child gets a total impression. The adult may begin with a total impression, but he begins at once to analyze the facial expression as having a "cold" or "warm" eye, a "slit of an eye," a "sneering" or "laughing" mouth, sinister lines, etc.

A second example will demonstrate further this process of progressive differentiation. The untutored ear hears a symphony as a mass of fused sound, more or less pleasant or unpleasant, having some sort of rhythm and tempo. But at this level of undifferentiated perception there is no discernment of themes, no apprehension of the forms in which these themes are being developed and manipulated. The untutored ear's level of undifferentiated perception does not permit the learning of much about symphony music; if indeed it permits even the distinction between one symphony and another. At this level, the music is perceived as a fused whole, but its structural characteristics and details are undiscerned.

Similar illustrations can be found in all perception and learning situations. As examples we may mention the following. The infant does not distinguish between himself

and the rest of the world; that is, there is no differentiation between the subjective and the objective. Temper tantrums of the young child become the clenched fist or square jaw of the adult. Children of six and seven are still egocentric in their perception and reasoning. The development of color vision proceeds from the merest distinction between light and dark by progressive stages to the perception of the finest nuances. The infant's aimless babbling develops into articulated words. The growth of vocabulary reveals not only an increase in the number of words but growth, as well, in the nicer distinctions between words. Even as adults, when we come, say, into a new room or a new community we get a general, a fused, impression. Only later does the situation break down for us into its component parts, so that we understand what has gone into creating that impression. We get a pleasant or an unpleasant impression of a person or scene; but we are able to give a detailed explanation of that impression only after making a conscious effort to analyze the situation.

Discernment, then, proceeds from (1) the larger wholes to (2) the parts which go to make it up, to (3) the interrelationships of those parts, and to (4) the elements of the parts themselves. It is one function of education to enable the individual to refine his learning and perceptions so that instead of perceiving only the large, fused totality, he apprehends its members, structure, and inherent possibilities. This will become clear as we describe the development of learning under four headings: (1) learning by undifferentiated wholes; (2) learning by differentiation; (3) learning by assimilation; (4) learning by re-definition.

Learning by Undifferentiated Wholes. This form of learning, apparently the earliest, occurs when the individual learns *without discerning the members or parts of the situation as such*. The situation is responded to as a whole. This kind of learning can be illustrated by an experiment per-

formed by Köhler with hens. The problem of the experiment was to test the capacity of making a choice between objects of the same sort which vary from each other in a certain direction; that is, which show a certain direction of change. Upon a board before the hen coop, Köhler placed two gray papers differing only in shade, each of which held an equal number of kernels of grain. The hen was permitted to take food only from the lighter of the two papers, and was always "shooed" away from the darker. The experiment was so arranged that the only factor in the determination of the hen's choice was the shade of gray. After many trials (in some cases more than 400), the hen learned to select the correct paper almost invariably; in this instance the lighter of the two grays. Then a critical test was made. For the darker gray paper (which had acquired a negative character in the process of training), Köhler substituted a gray paper that was still *lighter* in shade than the one from which the hen had been permitted and from which she had learned to feed. The result was surprising. It is often supposed that training, as in this experiment, establishes a fixed connection between a given object and a given response. Now, if that were so, we should expect the hen to continue selecting the shade of the training-series from which it had previously been allowed to feed (that is, the paper that had acquired the positive character in the training series). But this did not happen. Instead the hen chose the *new* shade of gray, which was the *lighter* of the two in the second pair of papers.

With another hen similarly trained, the critical test consisted in keeping the unacceptable (or negative) gray of the original training-series and pairing it with a *still darker* gray. Here, it might be supposed that the originally unacceptable gray would continue to be refused and that the new shade would be accepted. But once more the lighter paper of the pair was selected, in spite of the fact that it had

acquired a negative character in the original training series.[19]

These foregoing experiments—and others dealing with positional reference (right and left), differences of size (larger and smaller), and geometrical designs (varying in a constant manner)—demonstrate that learning in its earlier stages and at the lower levels depends upon the perception of the situation as a whole, in which the parts or members that make up the whole are not discerned independently, but derive their significance from their membership in the total situation. At the lower levels of intelligence and perception, the criterion of selection and learning is the *direction* of change (in color, size, position, shape, etc.).

Similar results were obtained with apes and with a three-year-old child. With older children, however, and with human adults the results were different. For with increased ability of discernment, selection is made more and more upon the basis of the absolute or specific object, and less upon a relational basis. In other words, for older children and adults, the situation has become sufficiently differentiated so that they are able to perceive and learn to respond to the separate parts which have emerged as entities. Yet when the difference between two objects is small enough, a pair-wise or relational selection is the only one possible even for adults.

This kind of learning is, after all, rather crude. There is no insight at this level; for the learner is lacking in discernment, and his behavior is lacking in precision. The members of the situation are for him fused. If he is to acquire information and knowledge, and if his environment is to take on fuller significance and meaning, the learner must progress from this level of learning to the remaining three kinds.

[19] Cited in Ogden, R. M., and Freeman, F. S., *Psychology and Education*, New York, Harcourt, Brace, 1932, pp. 238-39.

Learning by Differentiation. In the choice experiments mentioned in the preceding section, the older child and the adult learned by differentiation, for they responded to a particular or specific member of the pair of colors, or sizes, or shapes, as the case may be. They were able so to respond because they could discern some of the properties of each member, which thereby achieved independence for these learners. *Learning by differentiation, then, signifies that the objects in a situation, their properties, and their interrelationships have been defined for the learner and have achieved a degree of independence.* Or, to put it simply, the learner, in a greater or lesser degree, perceives the elements of the situation. Thus by a process of differentiation in learning, one apprehends not only the whole situation as an integrated unit, but he apprehends the members that go to make it up, and the rôle of each.

If the individual is placed in a complex problem-situation which he is required to understand and solve, there must be differentiation if he is to solve it with insight. Otherwise there can be only a chance solution which need not necessarily be understood by the intended learner. But this is not true learning. As an example of chance solution, we may mention Thorndike's classical experiments with cats and dogs in puzzle-boxes.[20] Hungry animals are confined in closed cage-like boxes, in front of which food is visible. The box has a door of some sort which opens as soon as the animal has performed the right act, such as pulling a string, pressing on a board, turning a lock, or otherwise manipulating a mechanical device. It is not surprising that the animals, as a result of these experiments, were regarded as essentially stupid. The difficulty was that the problem was much too complex for these animals; the elements in the situation and their rôles did not appear for them. There was no differentiation.

[20] Thorndike, E. L., *Animal Intelligence, Experimental Studies*, New York, Macmillan, 1911.

Animals higher in the scale than cats and dogs will also fail of a proper solution if differentiation is not possible. Köhler tried the following experiment with apes.[21] "A long thin string is tied to the handle of a little open basket containing fruit; an iron ring is hung in the wire roof of the animals' playground through which the string is pulled till the basket hangs about two meters above the ground; the free end of the string, tied into a wide open loop, is laid over the stump of a tree-branch about three meters away from the basket, and about the same height from the ground; the string forms an acute angle—the bend being at the iron ring." The idea, of course, was to have the intended learner remove the loop from the branch, whereupon the basket would fall to the ground. But the problem was too difficult even for the cleverest of the apes whose behavior is described as follows: "After a time, Sultan suddenly makes for the tree, climbs quickly up to the loop, stops a moment, then, watching the basket, pulls the string till the basket bumps against the ring (at the roof), lets it go again, pulls a second time more vigorously so that the basket turns over, and a banana falls out. He comes down, takes the fruit, gets up again, and now pulls so violently that the string breaks, and the whole basket falls. He clambers down, takes the basket, and goes off to eat the fruit."

Here, to be sure, the ape attained his goal. He got what he wanted; but he did not learn to solve the problem confronting him. We might say he "muddled" or even "bulled" his way through. The reason he failed to solve the problem as any ordinary human being would have is that the elements and their relationships, or rôles, did not emerge (differentiate) for him. The set-up was too complex and the relationships, apparently, too subtle.

Although the foregoing experiments yielded negative results, they nevertheless reveal the importance of differentiation in learning. The following examples will, however,

[21] Köhler, W., *op. cit.*, pp. 7-8.

provide positive evidence. The connection between the animal and the fruit was provided by an intervening link: in this case a string attached to the fruit. The purpose of the experiment was to see if the animal could make use of the connection, already provided, to draw in the banana. To do so, the animal must perceive the string and its relationship to the fruit. Each of the objects and their connection must emerge if the problem is to be solved. The task was within the range of intelligence of most of the apes. The problem can be complicated, without changing the principle involved, by having more than one string lead from the fruit to the animal, but only one of which is attached.

In another experiment a swinging rope, suspended from a horizontal bar, was wound over the same bar three times in a manner easily apprehended by an ordinary human being. In order to reach the goal, the rope, being essential, first had to be uncoiled before it could be used. The brighter apes were able to meet the requirements of the situation, whereas the others simply pulled at the loose end, and, of course, failed.

The process of differentiation in children's learning is clearly demonstrated in an experiment [22] using "thirty cards of different colors, some plain, others marked with gilt moons and stars in different arrangements. The child was told that two which were shown to him were called *A*. One of these was blue with a moon and star upon it; the other was yellow and similarly decorated, except that the moon and star were not in exactly the same relative positions. He was then asked to pick out all the other *A's* from a pack, none of which was identical with the blue or the yellow as to arrangements of the moon and the star." The youngest children selected all the cards having marks of any kind, disregarding only the plain ones. Somewhat older children

[22] Hazlitt, V., "Children's Thinking," *British Journal of Psychology*, vol. 20, 1930, pp. 354-361.

selected only those cards having one moon and one star, disregarding both the plain ones and those having marks other than one moon and one star. These two groups of children chose without reference to color. The brighter children seven and eight years of age, in their selections, chose only those cards that had the moon and the star in the same relative position as in the samples. Some of these children, however, selected only those cards that had the same colors as the samples. We see here a progressive analysis and refinement of behavior from the youngest children's simple categories of selection to the highly selective classification of the brightest among the older children.

These experiments with apes and children, though relatively simple to the experimenters and to normal adult human beings, are of prime significance in understanding all learning. The experiments were challenging to the intended learners, yet within their range of apprehension; and they were of such a character as to be free from the influence of specific training which would have obscured the nature of the learning processes involved.

Learning by differentiation, then, is learning through analysis of a totality. The developmental course of perception and learning is from the relatively vague and undefined (or fused) to the discernment of objects, properties, and relationships. The only things an individual can know are those things he can differentiate from the rest of his environment. Hence, learning by differentiation is essential to mental development.

Learning by Assimilation. *Learning by assimilation means the formation of two or more objects into a new meaningful unit or whole.* Assimilation therefore presupposes differentiation. Differentiation, we have stated, involves a degree of analysis of the totality. Learning by assimilation, on the other hand, is a process of synthesis.

Once more, we may use one of Köhler's experiments as

an illustration.[23] A banana is placed outside the chimpanzee's cage, just beyond his reach. Inside the cage is a stick with the aid of which the fruit can be pulled in. The ape has never previously been observed to employ a stick as a tool; nor does he, in this instance, apparently see any connection between the stick and acquisition of the desired fruit. Instead he reaches vainly through the bars of the cage, time and again alternating his futile efforts with other activities. In fact, he may even play with the stick without perceiving its possibilities as a tool to be used in getting the banana. But, *when by chance the stick and the fruit fell together in the line of his vision*, the situation was suddenly altered; for the stick was at once correctly used in securing the fruit.

The appropriate behavior was thus learned in one successful trial. Favorable conditions arose under which the ape was able to perceive stick and fruit together, whereupon the two became at once members of a new pattern, or whole. Throughout the ape's activity, it must be remembered, there was the felt need to secure the fruit; a state of tension existed. Thus, the animal's "set" was favorable to the perception of the new pattern. It should be noted also that learning took place suddenly—after only one trial; there was no random trial and error, no gradual elimination of wrong moves nor gradual acquisition of right moves. We shall have more to say about this later when we discuss the topic of frequency of repetition.

Alpert,[24] using Köhler's methods with young children, found the same kind of behavior as that shown by the apes. She reports:

> First exposure (girl, 32 months of age): Subject reached with her hand over the top of the pen, shook the bars, stuck her leg out through the space, sought an exit, again shook the pen, tried to reach objective, with her hand over the top of pen, leaning

[23] *Op. cit.*, pp. 31 ff.
[24] *Op. cit.* (case 43).

over as far as she could, repeating in rapid staccato, "I can't get it;" looked around, directly at stick, at objective outside the pen, at Experimenter. Subject reached as before and looked around bewildered.

Second exposure. Subject stuck her leg outside the bars, shook the bars, and in 15 seconds picked up the stick and said, "Stick;" waved it tentatively outside and then suddenly began to angle for objective as though the idea had just occurred to her.

(Later.) Subject used broom for objective at once and deftly.

Many other similar experiments with these apes and children are reported; experiments in which a variety of situations were presented, demanding the assimilation of a variety of objects into a single unified pattern of behavior for the solution of the problem-situation. The experiments demonstrate that the processes of differentiation and assimilation create new things to our view and new responses in our repertory of behavior.

The educational implications of differentiation and assimilation as ways of learning are clear. In respect to the former, it is evident, first of all, that if knowledge is to be acquired it must be within the range of the learner's ability; otherwise we shall get the same kind of behavior as that manifested by the apes who could not see the connection between the rope and basket, nor the manner in which to uncoil the rope from the bar. This first implication is, it seems, a self-evident fact; yet it has been and is ignored in methods of instruction which rest primarily upon repetition of an act for its own sake, or upon simple imitation of and direction by the teacher, in a task which is really the teacher's and not the pupil's.

The second implication is that the lesson, subject, topic, problem, or what not, that is to be learned shall be well defined, its parts or steps well delineated, and the connections clearly indicated. That is, with the teacher setting up an appropriate situation the learner will make the necessary differentiations. Otherwise, there may be confusion and

uncertainty; learning may be fragmentary and uneconomically achieved. Or the learner may simply "go through the motions" of the act without having any insight into what he is doing.

The process of assimilation implies, especially, that if the learner is to master a new achievement or solve a problem, he must be able to apprehend the objects or steps involved as members of a whole; he must be able to give heed continuously to the task as a whole. Such apprehension permits the objects or steps to fall into place, so to speak.

Finally, without the process of assimilation there could be no original or creative achievement. For, as has been said, assimilation means the formation of new patterns; the reorganization of objects and concepts into new ways of doing things and achieving broader understandings.

Learning by Redefinition. *Learning by redefinition means that one and the same pattern or object may serve in different ways and in different contexts.* This kind of learning signifies simply that, with learning, a person apprehends multiple possibilities within an object, or other perception; whereas before, the same thing had but one. The educated person (not necessarily the "schooled" person) should be enabled to perceive various distinct possibilities in a situation or an object which to others might have but one possibility or meaning, or might even be ambiguous and confusing.

We may again illustrate this way of learning by experiments with and observations upon apes and young children. In one situation, Köhler did not make available a stick with which the apes might draw the fruit into the cage. In searching about for a tool, some of the animals broke a branch off a tree within the enclosure, and with it got the fruit. Another ape rushed off to its sleeping quarters, fetched a blanket, and tried to flip in the banana. In still another situation, the apes used boxes to stand on to reach fruit suspended from the roof, having fetched the boxes from remote corners. Children in Alpert's experiments

used large blocks in the same way. In these instances, and others as well, we have examples of redefinition; for the animals and children had achieved a new form of behavior through perceiving a new quality, a new possibility, within objects that previously were used in other ways in earlier contexts.

The child's activities with a box or a block furnish further illustrations. Altered conditions which arise from the infant's and child's development and extension of activities make a box or block, for example, not one thing, but several. The important fact is that improvement of any kind is a transition from indistinct behavior to precise, specific, and extended behavior. The young child comes to see the novel possibilities of a box as a building block, as an object to mount or to sit in, or as a surface to scrawl on. He sees the block not only as an object to push about and to pile upon others, but as something to be used as a hammer. While these emergents, these added possibilities, will be new, they are favored and promoted by the preconditions established by antecedent experience and action.

Redefinition is evidenced in any situation wherein anything is given a new application: in figures of speech; in the novel utilization of a scientific principle, as when suction was utilized in the vacuum cleaner; in the adoption and adaptation of mathematical methods in the solution of heretofore unencountered problems; as, for instance, the lifting of many mathematical methods from the physical and biological sciences for use in the social sciences.

Thus, by redefinition a technique or knowledge acquired in one situation can be employed in other quite different situations. It has sometimes been supposed that all learning is specific, meaning that what one learns are specific things and acts which are useful in later situations only insofar as the later situations possess elements or procedures identical with the things and acts previously learned. The fallacy of this supposition is amply demonstrated by the preceding illus-

tration; since there are no elements inherent in a dirty rug that are to be found also in the principle of suction. Suction was first used to *draw up* water from a hole or container. It is now used in a vacuum cleaner to *draw up* dirt from a rug. None of the *elements* of the tri-dimensional, wet situation of pumping water are duplicated in the separate particles of dirt on a flat, dry rug. But there is in vacuum cleaning an adaptation of the general principle of lifting something up or drawing something out which has been taken over from water pumping. The individual must have insight into the essential features of the several things or activities involved; and by an act of achievement, which he himself must supply, he is able to create something new. This is an instance of the intelligent recognition of similarities in very different situations as contrasted with the automatic operation of identical elements.

Summary of the Four Ways of Learning. We have considered the four ways of learning separately, but only for convenience of treatment. The four ways of learning can be found at different levels of behavior; and any single situation may demand several or all four. To illustrate that the four ways can be found at different levels and at the same time within the same individual, consider the young child. As indicated above, he is able to redefine blocks, boxes, and other objects with which he has had antecedent experience; yet his language shows every evidence of perception and learning by wholes, for he may still be using the "sentence-word"; [25] or if he is using more than one word in a sentence, his sentences may still be little differentiated as regards word order, word forms, etc. In other words, some aspects of the child's world are differentiated, redefined, and enriched earlier than others.

The same principle holds for the adult. The physical

[25] The "sentence-word" is a single word employed to express a want or describe a situation for either of which the older child or adult would use a sentence. The young child may say "box" when he means "I want to play with that box."

scientist, for example, in his specialty may perceive at the highest levels of differentiation, assimilation, and redefinition; and yet his perceptions in music, painting, sociology, economics and the like, may be at the level of the novice; namely, perception and learning by crude, undifferentiated wholes.

The second point—that any situation may demand any or all four ways of learning—is demonstrated by one of the experiments already cited; namely, the one in which the ape breaks off the tree-branch to be employed as a stick. The emergence of the branch, in the ape's perception, as an independent part of the tree demonstrated differentiation. Perceiving that the branch had the qualities of a stick and could be used as such is a case of redefinition. Using the branch to solve the problem was an instance of assimilation. In fact, there can be no creative behavior without assimilation; and creative effort will be seriously restricted without redefinition.

Our examples illustrating the ways of learning have been selected largely from the behavior of animals and young children in order that the beginnings of learning and achievement might be made clear. For it is only by understanding the origins of learning that we are able to plan and carry out appropriate methods of learning with human beings; in particular, with children in the school. Though we have used animals and young children in concrete situations as examples, the same principles of learning that apply to thing and events apply also to ideas and are the processes which guide the formation of concepts. As evidence of this fact in the schools, we find that things and ideas are being studied in their relationships. The point is that if the intended learner is to understand a principle or, say, an institution, he cannot do so until he perceives it in its relationship to the whole setting or to the culture of which it is a member, or part. Isolated from the setting or culture from

which they have emerged, principles and institutions are abstractions not readily or truly apprehended.

The Conditioned Reflex as a Form of Learning. The conditioned reflex (also known as the conditioned response and the conditioned reaction) is a specialized and limited form of learning that has been the subject of considerable discussion and experiment. We shall present only briefly its principal characteristic and indicate its meaning for learning.

Experiments on the conditioned reflex were begun by Pavlov, the Russian physiologist, who, using dogs as his experimental animals, studied the so-called "psychic secretions" of their digestive juices. The secretions most widely and most often investigated were those of the salivary gland. Ordinarily, if a drop of weak acid is put on the dog's tongue, he will salivate. He will also respond with a flow of saliva if he is hungry and is shown food to which he is accustomed. The acid and the food are known as adequate or unconditioned stimuli. On the other hand, there are in the environment numerous indifferent stimuli which will not cause the dog to salivate. Now, the object of the conditioned reflex technique is to develop in the animal a response to a stimulus which previously did not evoke that response. Thus, in this instance, the problem would be to cause the dog to salivate when a bell is rung; the sound, of course, being originally an indifferent stimulus.

For this purpose, a small fistula was made in the dog's cheek, and through this a tube was inserted into the opening of the salivary gland. In this way Pavlov was able to measure the activity of the salivary gland by collecting the saliva in a graduated test tube. When the hungry animal was presented with his customary food, the salivary glands became active, as was to be expected. Then on many consecutive occasions a bell was invariably rung while the dog was eating. After many such repetitions the bell was rung without presenting the food; and it was discovered that the

salivary glands became active, as they had previously when food was also present. In other words, salivation had become conditioned to the ringing of a bell, although originally the sound of the bell had no effect whatever upon this secretion.

Since Pavlov's work, many other experiments similar in technique have been performed with man and animal. The scope of these experiments and the relatively restricted character of the forms of behavior involved are shown in the comprehensive summary and survey of the subject made by Hull.[26]

He classified the experimental work into the following divisions, namely, conditioning of the knee-jerk; the plantar reflex; the abdominal reflex; the Achilles reflex; reflex withdrawal from a painful stimulus; the reflex wink; the pupillary reflex; disturbances in amplitude and rhythm of breathing; disturbances in amplitude and rhythm of pulse; vasomotor constriction; the galvanic skin reaction; rise in pitch of the voice; the fetal "kicking" reaction; food-taking reactions of new-born infants; food-taking reactions of children from three to six years of age; gastric secretion; salivation; vomiting; defecation and urination; diuresis; defensive blood reactions to immunity.

In the case of infants and children, especially noteworthy are the conditioning experiments with the so-called "fear response" (catching the breath, trembling, suddenly closing the eyes, clutching with the hands, puckering the lips, whimpering, crying, turning away, and fleeing). Earlier experiments by Watson had shown that infants manifested the fear response when subjected to sudden loud noises or to loss of support. By employing the conditioning method, it was found that originally innocuous animals—such as a white rat—could by themselves be made to evoke the fear response

[26] Hull, C. L., "Learning. II. The Factor of the Conditioned Reflex," in *Handbook of General Experimental Psychology* (C. Murchison, ed.), Worcester, Mass., Clark University Press, 1934.

when their presence was coupled with sudden loud noises, in the same way that salivation in dogs was obtained with the ringing of a bell.[27] In fact, the conditioned fear response established with the white rat transferred automatically to other furry objects like a rabbit and a fur coat.

Since the Watson experiment, numerous variations in conditioning of emotional responses have been performed with infants and children. And although child psychologists describe in children such emotions as anger, fear, jealousy, joy, and affection, it is nevertheless a fact that practically all experiments in emotional conditioning have used avoidance responses as in fear, but not attraction responses as in affection.[28]

In these experiments it was found that emotional responses could indeed be conditioned. And it was found also that the conditioned fears could be "unconditioned." That is, fears that had become attached to originally innocuous objects (like the rabbit) could be eliminated by gradual and agreeable association of the fear-arousing object with desirable objects and activities (like cautiously introducing the rabbit into the eating situation while the child is having a pleasant meal), or by observing other children who had no conditioned fears.

Early in the history of conditioned response experiments with children and infants, it was supposed that here was a simple and universal principle of associative learning; a principle that would explain all learning as being simply the association of a particular stimulus with a particular response, both happening to occur simultaneously. But the

[27] Watson, R. R., and Watson, J. B., "Studies in Infant Psychology," *Scientific Monthly*, vol. 13, 1921, pp. 493-515. At present, the prevailing view among child psychologists is that the infant and young child are not naturally fearful of loud noises and loss of support as such, but, rather, that fear is manifested when the stimulus or situation is experienced suddenly and unexpectedly. This fact, however, does not affect the significance of the Watsons' experiment.

[28] See Jones, M. C., "Emotional Development," in *Handbook of Child Psychology* (C. Murchison, ed.), Worcester, Mass., Clark University Press, 1933

matter is not so simple and rigid as that. Those who have been working with the conditioning of children's emotions now recognize that the child responds as a *total organism* and that he is being conditioned in a *total situation*. Children, for example, can be emotionally conditioned to certain stimuli in the environment of the laboratory, but apparently equivalent stimulus-situations in other and more familiar settings have no effect; the conditioned response is not evoked.

In other words, then, what happens is that the organism is conditioned by the given stimulus (as the ringing of the bell, in the case of Pavlov's dog) *in a certain context*. In the case of the dog, the conditioned salivary reflex did not operate unless the time of the day was kept constant, unless the animal was hungry, and unless the surroundings remained unaltered. In fact, it was found necessary to place the experimenter outside the room—because of the disturbing effect of his presence upon the animal's responses—and to develop, therefore, mechanical devices for observing the animal and measuring the reflex. In this connection Pavlov states: [29]

> When conditioned reflexes are being established in dogs for the first time, it is found that *the whole experimental environment*, beginning with the introduction of the animal into the experimental room, acquires at first conditioned properties. The initial reflex could be called, therefore, a conditioned reflex *to the environment*. But later on, when the special reflex to a single definite and constant stimulus has appeared, *all other elements of the environment gradually lose their special conditioned significance*. [Italics are ours.]

What takes place, then, both in the case of the dog's salivary reflex and the child's emotional response is that at first the response is given to the situation as a whole. And if a single and definite stimulus or aspect of the situation

[29] Pavlov, I. P., *Conditioned Reflexes* (translated by G. V. Anrep), Oxford University Press, 1927, p. 115.

emerges as the effective conditioning element, it does so gradually. Learning by conditioning, therefore, is subject to the process of *differentiation,* already discussed. Conditioning is not simply a matter of somehow tying together a response and a stimulus that supposedly had no organization or unity originally.

Thus, learning by conditioning is indeed a psychological fact. Conditioning offers a principle that describes the way in which certain behaviors are acquired or modified. But, as Hull's summary makes clear, experiments on learning through conditioning have been concerned, for the most part, with very restricted and specialized forms of behavior, aside from the conditioning of some emotional responses in infants and children. The extent and importance of the conditioning process in other and more complex forms of behavior and mental functions are doubtful, and at best only very uncertain. So far as human behavior is concerned, the conditioning process—as interpreted above—appears to be most significant in the conditioning and unconditioning of emotional responses.

The four ways of learning, discussed earlier in this chapter, and the illustrations of learning which were cited do not lend themselves to an explanation or description in terms of conditioned responses. It should be noted that conditioned responses are established after numerous repetitions of stimuli, and at times only after great difficulty. Also, it is to be observed, if the conditioned response is to be maintained, it must continue to be reinforced by the originally adequate stimulus; otherwise it becomes attenuated and fades out.

In order to have a clearer view of the problems of learning and to see more clearly where the principle of the conditioned response is or is not applicable, it is necessary to compare different forms of learning. Consider the instances of learning with insight, wherein the animal and child acquired forms of behavior after only one successful effort; and wherein the successful effort was provided or created by

the individual himself. Furthermore, once the behavior or solution to the problem had been learned, it was retained. Again, the conditioned reflex principle does not account for reflective thinking, creative activity, and the ability of an organism to deal adequately with a new situation for which he has no ready-made response established by conditioning or otherwise. That is, conditioned responses do not account for spontaneous and newly emerged expressions of behavior, which some have called "creative resultants." On the contrary, if the conditioned response were the universal principle of learning, an individual could behave only in stereotypes which had been fixed by training. We may cite several examples which, while being far removed from creative activity, still transcend the conditioning process: a child spontaneously and without previous training uses a block as a hammering tool; an ape fetches his blanket with which to flip a banana into his cage, in the absence of a stick; an adult uses the cover of a tea kettle as a saucer; apes climb up boxes and upon the shoulders of their attendant in order to reach fruit suspended from the ceiling; a child understands the meaning of "opposites" or "opposition," and consequently is able to give the opposites of words which he has acquired singly, but not at all as antonyms. Invention of figures of speech, or mechanical devices, or of any other sort would be precluded if conditioning were the universal principle of learning and behavior. The number of illustrations can be expanded almost indefinitely.

We repeat, then, that conditioning, as set forth in the quotation from Pavlov and as shown in the modifications of children's emotional responses, offers an adequite principle in the case of a limited group of activities, but does not account for other complex and significant kinds of learning and behavior.

Creative Activity. In the preceding discussion we men tioned creative activity as a kind of learning and behavio not to be explained in terms of conditioning following th

repetition of fixed stimuli. Since creative behavior is receiving increasing emphasis in the educative process, it is desirable to state several views with regard to the psychological processes involved, even though unequivocal evidence in this realm of activity is meager and difficult to obtain. Available evidence consists largely of introspective reports from reflective and creative minds such as poets, prose writers, painters, musicians, and scientists; as well as psychological analyses of their methods of work and of the partial and preliminary products of their efforts.

Graham Wallas[30] outlines the several steps involved in a creative act as follows: The first is the stage of *preparation*, during which the problem is investigated in all directions. The second is the stage of *incubation*, during which the problem is undergoing a process of assimilation and organization, although the person does not seem to be consciously active on the problem. The third is the stage of *illumination*, during which there emerge the new ideas, sudden insights, and valuable suggestions. The fourth is the stage of *verification*, in which the problem is concluded by putting to the test the product of the first three stages.

In discussing children's creative work in art, Rugg and Shumaker[31] state, first of all, that such activities "can only be induced by making all the conditions favorable to their inception." Then they list four steps in the creative process. First, there is the urge to create; the desire to manipulate objects in the environment, to explore, test, and control them. This is essentially the same as the original motive to behavior that we have called curiosity in an earlier chapter. Second, they say, there are "illuminating flashes of insight." The individual selects and interprets the materials he is dealing with; his continued scrutiny is essential if insight is to grow. Third, the individual must master the necessary

[30] *The Art of Thought*, New York, Harcourt, Brace, 1926, p. 80.

[31] *The Child-Centered School*, Yonkers, N. Y., World Book Co., 1928, chap. 19.

techniques which are a "preliminary essential to creative productivity." Fourth, and finally, the individual must be willing to continue the "long, grueling enterprise," to maintain "the tenacious grip on the clearing vision of the completed product," since "the essence of the task is the will to see the job through." It can be added that the will, zeal, and energy indicated here are in part dependent upon the individual's felt need to perform the task and his apprehension of the goal towards which he is striving.

Spearman presents three psychological principles which, he states, constitute an act of reasoning and are essential to the creative mind. He states them as follows:[32] First, "Any lived experience tends to evoke immediately a knowing of its character and experiencer." This is a mental state which is "lived" or "undergone." Second, "The mentally presenting of any two or more characters (simple or complex) tends to evoke immediately a knowing of relations between them." Thus, the individual, on being confronted by two or more items in experience, will tend to apprehend the relation that exists between them, provided, presumably, that the situation is within the range of his perception. And third, "The presenting of any character together with any relation tends to evoke immediately a knowing of the correlative character." This is exemplified by one's ability to supply analogies. (Hand is to glove as foot is to ——. Or, black is to white as big is to ——.)

These analyses are cited not because they are the final word but rather because they all agree in emphasizing the active and constructive character of mental activity. Not all analyses and views of reflective thinking and creative activity are in agreement, as can be seen from the three already cited; but, unlike the conditioned response theory, they *all* do regard mental activity as being of a dynamic and seeking character. Now, though the conditioned response theory is adequate as a principle regarding certain limited kinds of

[32] *Creative Mind*, New York, Appleton, 1931.

behavior, it is inadequate to explain some of the most important activities in the educative process: namely, reflective thinking and creative activity.

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Chapter X

CONDITIONS AND RESULTS OF LEARNING

Development of Skill. Skill, a product of learning, signifies ease and precision in the performance of an act. The acquisition of an act of skill demands more or less refinement of response (depending upon the act); that is, reduction of irregular, jerky, mass movements to the achievement of finer adjustments of control, detail, facility, and speed. And here once more the development of skill, as a form of learning, demonstrates the principle of *progressive differentiation* which was emphasized in the preceding chapter. It will be relevant and worthwhile, therefore, to trace briefly the sequence of motor development and control in the human infant and child; for progressive differentiation from mass activity to specific segmental activity in motor behavior is there clearly revealed [1] and is essential to the later acquisition of skill.

Throughout the first ten days of life, mass activity predominates in the human infant, consisting of generalized bodily movements in which several or many parts of the body move simultaneously. During the first week, the eyes, the first organs to come under muscular control, make occasional attempts to follow a moving light or a bright object. By the age of two or three weeks, they will focus on a person. Then by about five weeks the eyes will follow an object moving horizontally; by about nine weeks, an object moving vertically; and by about ten weeks, an object swing-

[1] Cf. Shirley, M. M., "Locomotor and Visual-Manual Functions in the First Two Years," chap. 5 in *Handbook of Child Psychology* (C. Murchison, ed.), Worcester, Mass., Clark University Press, 1933.

ing in a circle. It is held that an infant by the age of about 12 weeks attains the adult level of motor control over the eyes. It should be observed, however, that this refers only to motor control but not to the various forms of visual discrimination, as in size, shape, and color.

In matters of rather gross motor control, progress is as follows. By the age of three weeks the baby is able to lift its chin when it is lying in a prone position. By the end of three months, the infant has attained a good degree of control over the muscles of his eyes, head, and neck. Control then develops downward and outward, proceeding to the shoulder, then to the arm and upper trunk region. At this stage, the infant is able to make shoulder adjustments and, at about 14 weeks, to reach for objects that are offered him. Several weeks later control and differentiation have progressed to the point where he is able to touch and grasp the objects.

Development now proceeds to the lower trunk and legs; for at the age of about 30 weeks, the baby is able to sit alone for a very short time; and about two weeks later he can stand with assistance, straighten his knee-joints and place his feet firmly. Shortly thereafter, at about 38 weeks, the infant begins to creep; at 45 weeks, he can walk when led; at 47 weeks, he is able to open simple boxes. By the time he is about 60 weeks old he has developed sufficient control to place his fingers into holes; while six weeks later he walks alone, runs, and climbs.

This brief sketch demonstrates progressive differentiation and control from the eyes to the head and neck region, to arms and upper trunk, to hands and lower trunk, and finally to the pelvic region, legs, and fingers by the time the baby has reached an age of about 15 months. The ages here given at which the several stages of development occur are averages; which means, of course, that some infants attain the various levels earlier while others attain them later, depending in all these acts upon the child's rate of maturation

and, in some instances, upon the circumstances of development.

The child's second year is marked by an appreciable increase in the skill with which he uses the body-parts that have become differentiated during the first 15 months. "He opens simple boxes, unscrews the lids of jars, put pegs into holes, scribbles, then draws a straight line on paper, turns the leaves of books one at a time, and builds a tower four or five blocks high. By his second birthday he has achieved a fair degree of control over his entire body musculature." [2] But even so, much of his motor control and behavior is *relatively* crude. From this age on increase in strength and size, of course, facilitates further development of skill: but the essential feature of that development is the increase in refinement and precision, as well as speed, of behavior, depending significantly upon opportunities for training and upon the growth of perception.

It is clear that whatever increase in motor skill the child attains with development is a result of progressive refinement and the *emergence* of segmental acts; but it is not a result of the mere addition or elimination of movements that were previously separate and independent. In other words, the acquisition of a skillful act in the child, and in the adolescent or adult as well, is the result of this very process of progressive differentiation and is not achieved by building up or putting together elementary or part movements. In our discussion of original nature and maturation, we stated that there are optimal times for giving training in various activities—that time being when a particular interest or activity begins to manifest itself. Therefore the deliberate acquisition of a skill should best be begun when the child is at the appropriate level of maturation, the skill developing as a process of progressive differentiation and refinement.

Consider, for example, the activities of a child learning to

[2] Shirley, M. M., *op. cit.*, pp. 245-246.

write. He moves not only his hand and arm, but his shoulder and head as well. His tongue and feet may participate; his entire body may even squirm. He gradually develops segmental control and behavior of the hand and fingers, eliminating all extraneous movements. With increased skill, he can, if he wishes, give heed to the details of the letters he is forming, achieving various effects. Indeed, later on skill in writing is so fixed that it becomes the tool of an entirely different behavior: namely, the recording of thoughts, while the writing process itself, and in fact the words themselves, go unheeded.

Similar developments may be observed in other acts of skill. In learning to play tennis, for instance, it would be fatal if the learner, as he is about to hit the ball, were to try consciously to fit together what he might have learned about the position of the feet and elbow, the function of the wrist, the angle of the racket, etc. The best procedure in teaching a skill of this kind is to show the learner the proper grip on the racket, show him the general, or total, body position, tell him to relax and swing freely at the ball to get "the feel" of a proper stroke. When he has achieved this, he will then discern the rôle of this or that twist of the wrist, the effect of changed foot position, etc. Likewise a skillful baseball player can "place" his hits because he has discerned the effects of the contributing factors in batting, but only after he had discovered and fixed the rhythm of batting the ball as a single, continuous act.

We may turn to playing the piano or violin as distinctly different activities, but such, nevertheless, as involve the same principle of development and segmental emergence. The beginner on these instruments finds it difficult to achieve the necessary finger independence. Only through a process of drill and training does he arrive at the point where each finger is under control. Yet in piano playing, the performer, if he is to be expert, must attain a degree of finger independence which will enable him, by exerting different

amounts of pressure with different fingers, to sound one note louder than the others in striking a chord. Such precise control emerges from what was the relatively crude and undifferentiated behavior of the hand to begin with.

Industrial psychologists who have studied operations and movements of skilled workers stress the same principle. They emphasize the fact that to teach an act of skill by an isolation of its elements is to distort the pattern or organization of the whole. Instead, they advocate the whole-method whereby the act is performed. *Afterwards*, if necessary, the act may be separated into its natural subdivisions; but even so, they maintain, each subdivision should be kept as large as possible in order to profit from the relationships and integration inherent in the task as a whole.[3]

In some cases, where the task is a very complex one, a modified whole-method might be preferable. But even in these instances it has been found desirable first to give the learner a view and apprehension of the process as a unified whole. The modified whole-method is, in fact, a special case of the whole-method; for what it does is to take an entire process or unit which is too large to be compassed by the learner as a whole and divide it into sub-units which are relatively self-contained and which can be apprehended as wholes. Thus, it will be seen that so far as the size of the wholes is concerned in the acquisition of skill, the principle is the same as in memorizing.

We may generalize by stating that the pattern of the entire act of skill must be heeded, and that the acquisition of skill is not a recombination of distinct and separate acts which are practiced in isolation. Rather, the parts, after practice and discernment, emerge and may achieve a distinct character. If any part-movement were overemphasized in the learning of an act of skill, the effect would be detrimental to the performance as a whole.

[3] See, for example, Viteles, M. S., *Industrial Psychology*, New York, Norton, 1932.

It has been stated that at the early stages in learning an act of skill, the individual does not discern the elements and their interrelationships that go to make up the whole act. Instead, his criterion of achievement is a feeling of fitness or appropriateness that accompanies the act: the feeling of balance, rhythm, and ease that is recognized as appropriate. This, to be sure, is rather intangible; but it is none the less real. Every performer, even the most expert—in athletics and music, for example—has the experience of getting or losing the "feel" of the act. "Bad" days are those on which they have lost the "feel." Not infrequently, a highly proficient performer is unable to tell others how to achieve his results; for though he is very competent, he has not consciously discerned the organization of his pattern of behavior, as is necessary for teaching it; and he is, therefore, unable to teach others. To this extent teaching is different from doing. This is one reason, and an important one, why the best athletes and musicians are not infrequently poor teachers of their specialties.

This feeling of fitness or appropriateness, once experienced, leaves a disposition to repeat the same rhythm under similar conditions. The act of skill, however, is not acquired in one successful effort. There will be continued trials, more or less incomplete and unsuccessful; but these trials will be studded with an occasional success, so that gradually a closer approximation to perfection is achieved in the course of repetitions.

Now, an act of skill, like any other learning, is directed toward a goal. As the entire act is perfected, the individual's attempts to achieve the goal become progressively more precise and direct. And as the goal of the skillful act becomes more exacting (for example, "placing" the ball in tennis, shading of tone in playing the piano), the individual's responses must become more and more controlled and refined. He is able to satisfy these more exacting goals because, as in the case of learning to write, the broad, generalized act of

skill, which is essential, has become fixed as a habit, and the performer is thus able to focus his behavior upon a new goal and a new type of response.

The Curve of Learning a Skill. The classical curve of learning a skillful act is shown in Figure 23. These curves were found by Bryan and Harter in their study of telegraphy, for both sending and receiving.[4] In the years that

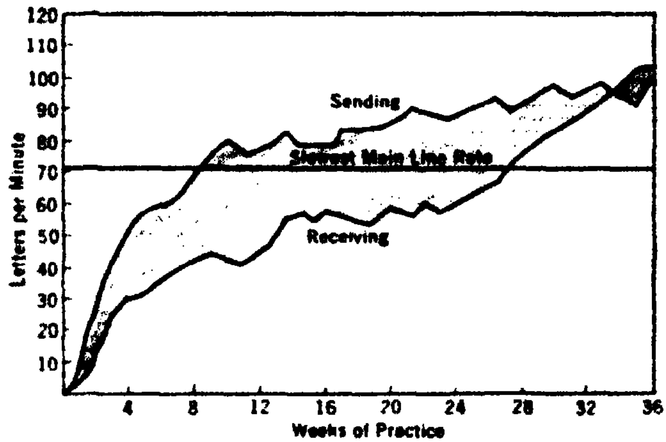

FIG. 23. Improvement in Telegraphy. Individual E.L.B. (After Bryan and Harter.)

have elapsed since their publication, the curves' essential validity has been established; for although curves found by other investigators might differ in detail, such as rate of improvement, certain essential characteristics are common to all of them (see Fig. 24).

The first obvious characteristic of the curve is its *initial rise*, showing a very rapid rate of improvement in early practice periods, the actual rate and duration of rapid progress depending upon the complexity of the task. The curve for simpler motor processes rises more rapidly and continues its initial rise longer than does that for the more complex processes. The reasons for this initial rise are probably these: (1) there are early and continued improvements in the or-

[4] Bryan, W. L., and Harter, N., "Studies in the Psychology and Physiology of the Telegraphic Language," *Psychological Review*, vol. 4, 1897, pp. 27-53.

ganization and refinement of movement, and so long as organization improves performance can improve; (2) the novelty of the situation and task provides strong interest and incentive which ordinarily decline as the individual continues

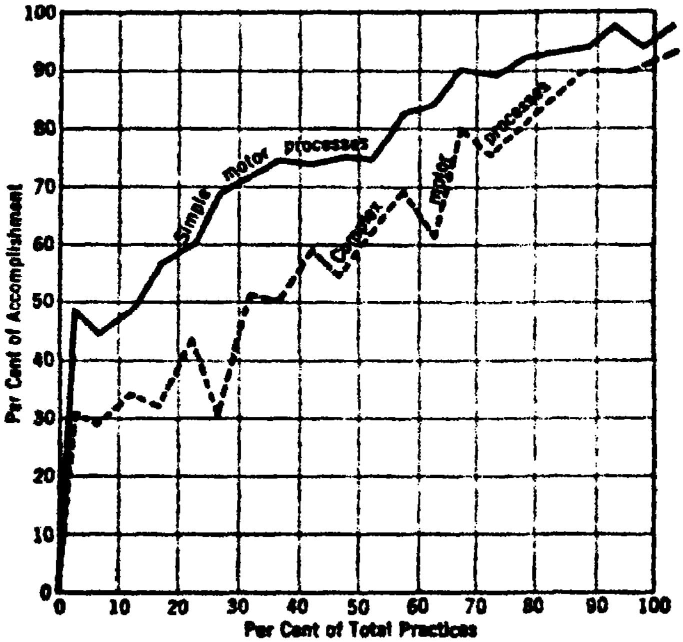

FIG. 24. The full line represents a composite of 9 studies dealing with simple motor processes while the broken line represents a composite of 20 studies dealing with complex motor processes. The curves show the relationship between accomplishment and continued practice as expressed in terms of percentages. For example, during the first 5 per cent of the total number of practice periods there is a certain per cent of the total accomplishment for the study. The highest degree of accomplishment is represented by 100 per cent and the total number of practice periods (irrespective of number) is represented by 100 per cent. (From R. A. Davis, *Psychology of Learning*, McGraw-Hill Company.)

with a task which is routine and rather monotonous in character.

In Bryan and Harter's curves, there are some very minor *fluctuations*, while in the composite curves the fluctuations are more marked. The reasons accounting for these may be one, or several, of many. The loss of initial interest and incentive might produce a temporary decline through the wan-

ing of attention and effort. There are other possible factors which might enter, such as fatigue and a negative emotional condition. The precise explanation of the temporary decline, however, can be known only through a study of the individuals involved. Although fluctuations do occur, the far more significant feature of the curve is its progressive rise until the maximum is attained.

In several of the curves here reproduced, there are periods of arrested progress when the curve flattens out and approaches the horizontal. These phases are called *plateaus*. Unlike fluctuations and initial rise, plateaus do not appear in all curves; nor are psychologists agreed that they need appear. Numerous explanations, each of which will be relevant some time or other, have been advanced in explanation of the plateau. At times there is a relaxation of effort and attention when the beginning tasks, already mastered, become too easy. The learner, therefore, must make a conscious effort to overcome this attitude. There are also times when the plateau is the result of an absence of incentive or purpose. It has been demonstrated, for example, that skilled workers of long experience, who had apparently reached their upper limit, or final plateau, were able to raise their levels of performance when increased incentives were provided. The same is true of children with respect to some of their school tasks. It does not often happen that an individual performs at the level of his *physiological* limit; that is, the limit of what his nerves and muscles are able to perform (and it is very doubtful that he should). Ordinarily in an act of skill, following prolonged experience, a person attains a reasonably good level of performance, but not the maximum. One might, of course, work at top speed in typewriting, or telegraphing, or card sorting (a common experimental device in studying the psychology of skill) in order to achieve the highest possible score in a small unit of time; but it is very doubtful if working at the physiological limit continuously over a long period of time is desirable or possible.

A third possibility accounting for the plateau is the method of work being employed; that is, the limit of achievement or usefulness of a poorer method has been reached, and further progress will depend upon the use of an improved method. In learning to typewrite letter by letter, for example, one may reach an upper limit, and consequently a plateau, beyond which he cannot advance, until he adopts a new method: namely, typewriting whole words as units. The validity of this point is supported by the fact that the plateau was not found in curves of typewriting when, from the start, the pupils practiced the typing of whole words rather than individual and isolated letters.[5] It will be seen in Figure 23 that the curve for sending does not have a plateau, whereas the curve for receiving does. This difference, it has been suggested, is very probably due to the fact that the messages to be sent are present and perceived as wholes, whereas the telegraphed sounds of the message being received arrive singly and thus favor a piecemeal method. This, however, is not true of the experienced telegrapher,[6] for whom the first several letters of each new word serve as the cue for the entire word, particularly in the context of the sentence he is receiving. The obvious educational implication of the improvement that follows a change of method is that the best methods of practice and instruction should be employed from the very beginning. For not only do inferior methods arrest learning, but such arrest may also lead to discouragement and abandonment of learning.

There is, finally, an explanation of plateaus which are really inherent in the process involved in learning particular skills. It is that there are halting places where adjustments and co-ordinations are essential before further progress can

[5] Barton, J. W., *Comprehensive Units in Learning Typewriting*, Psychological Monographs, no. 164, 1926. Also, Smith, M. D., "Periods of Arrested Progress in the Acquisition of a Skill," *British Journal of Psychology*, vol. 21, 1930, pp. 1-28.

[6] There are now probably relatively few such, since the telegraph key and receiving instrument have been replaced by the "teletype" machine.

be made. The practiced acts must become fixed and precise before more difficult and complex acts can be mastered. In a sense, the learner must "consolidate his position" before he is able to go on. This being so, it is correct to say that although there is little or no *measurable* progress during the period represented by the plateau, learning goes on nevertheless.

Teaching of Skills. Numerous activities in the course of a school career involve the acquisition and use of skill. These include typewriting, woodwork, industrial arts, trades, sewing, drawing, playing musical instruments, making apparatus, physical training and games, handwriting, and many others. It is essential, therefore, that known psychological facts and principles be utilized so far as possible, as indeed it is in the entire educative process.

First of all, the learner should from the very beginning be shown and practiced in correct form and method. For example, in learning to write, the child should at the start be given the correct posture at the desk; he should be shown how to grasp the pencil correctly; the position of the paper, hand, arm, and shoulder should be right; and he should be carefully observed in order that errors may be avoided from the beginning. Furthermore, in handwriting, as in all other skills, he should be instructed to relax, to reduce tensions so far as possible. Anyone, in fact, who has played the piano, or tennis, or baseball, or who has run footraces, or who has engaged in any skillful activity, knows the importance of relaxation.

After practice is under way, the learner's behavior should be directed to the goal or result to be achieved rather than upon the process itself. Attention to or concentration upon the movements interfere with the smooth functioning of the entire act. However, after the whole unit of behavior has advanced to a reasonably satisfactory level, there may be drill on part-movements of the act. This is possible and not

detrimental because the general pattern of the act has already been well enough fixed.

When a skillful act has been practiced long enough and a reasonable degree of proficiency developed, then various devices may be employed for increasing proficiency. Such include sketches, slow motion pictures, diagrams, and verbal analysis. But these aids should be employed only after the learner has reached a fairly advanced stage; for in the early stages learning by observation and imitation is negligible. No beginner ever profits much, if at all, from watching an expert perform, for the simple reason that the novice is able to see only the fused pattern of behavior, too complex and too rapid to be of value in learning. The relatively advanced and experienced individual can profit from observations because he knows what to look for, and he can ignore the total pattern. He has the right set; certain aspects of the whole will be prepotent for him. The beginner, on the other hand, must learn by doing and feeling the appropriateness of what he is doing.

It is sometime useful to think over one's results after practice periods; for this might help to reveal phases needing particular emphasis. In this connection, it is very important that the teacher make frequent observations of the learner's performances, for the teacher being experienced and proficient is able to discern the several phases of the act and their contribution to the result, good or bad.

In our discussion of memory, it was stated that spaced practice periods were preferable to massed practices. The same principle holds in the acquisition of an act of skill.

Finally, it is desirable that the individual have an incentive, whether it be in the form of commendation and encouragement, self-improvement, getting a job, social approval, or rewards and distinctions.

Habits. A habit is a form of learned behavior which is relatively invariable and readily elicited. It is a stereotyped mode of activity resulting from drill or training. It is, thus,

not in itself an explanation of behavior, but rather an end product of learning. Although a habit, at the time of its performance, is not a purposeful action, in the sense that it is not the result of judgment when it is being employed, it might originally have been purposeful or willful. Through training, however, the behavior has become fixed, so that it is no longer the focus of action; it has fallen into a subsidiary place.

We have already discussed man's original behavior equipment, or behavior potentialities. From these basic and broad potentialities develop specialized or stereotyped forms of action which are habits. For example, the routine employed in satisfying hunger is a case in point: the number and the hours of meals, the use of table implements, the kind of food preferred, the manner of conducting one's self at the table—the details of all of which have been purposefully acquired are now, in adulthood, habits of behavior. Again, in social behavior, we have been taught to conform to the social group of which we are members, so that group manners and conventions become fixed habits; and they are often too subtle in their origin for us to trace even when we become aware of their existence.

In fact, there is a great variety of habits in addition to social customs, fashions, and *mores*, and habits of eating. Most persons develop routines of work, study, recreation, sleeping, and play. One may also develop habits of interest, as in reading, moving pictures, and hobbies. Likewise, whereas one person might have become a habitual leader in a group, another might be a habitual follower; although this in no way implies that all persons can be classified as belonging to either one or the other of these two extreme groups. There are also the so-called nervous habits, or tics, which are spasmodic movements of any sort, repeated at frequent intervals, but having no significant relationship to the situation.

Finally, there are attitudes and habits of mind as well as habits of body. And these are of particular significance in

the educative process. It is true that useful and desirable habits enable a person to profit from earlier situations and behaviors by providing him with a ready action or behavior form in meeting new situations and problems as they arise. But too often attitudes and habits of mind simply signify a mind that is inert and, therefore, a handicap to progress. Habits of mind can be of greatest service, however, so long as they are subject to revision and not irrevocably rigid.

Granted that in some situations habits are desirable, they function best when the situation in which they were acquired changes little or none; and they are especially likely to become modified and adapted when the situation changes markedly in its important details. For example, one writer reports that he unfailingly reaches for his watch in the customary pocket when wearing his business suit; yet when the watch is shifted to a different pocket in his dress suit, no errors result. But should he become absorbed in conversation with his colleagues, thereby temporarily forgetting the formality of the special occasion, he will then make the error of reaching in the same pocket as the one used in his business suit.

That the functioning of a habit involves all the factors that affect the apprehension of conditions to which an individual is adjusting is shown by the manner in which very strongly fixed behaviors desert us under special circumstances. Consider, for example, the awkward walk of many boys and girls as they go across the platform to receive a diploma, whereas ordinarily their walk may be graceful and perfectly well adjusted. Or, again, consider the person who talks well and fluently with another individual or in a small group, but who flounders about or stutters when speaking in public. These are but several instances which reveal that even an often-repeated and well-fixed habit can fail us if the setting for its performance is not right. These instances demonstrate that mere repetition of an act, in and of itself, is not sufficient to guarantee its smooth functioning in all

situations. The practical suggestion emerging from this fact is that an activity should be practiced, whenever possible, in the setting where it is to be employed until the behavior becomes fixed in that setting. It would be desirable then to practice the activity in another setting, and still another, etc., until the act itself emerges as a form of behavior which can be relatively independent of a given and particular environment.

This brings us naturally to the question of the rôle of habit-formation in education. There are some theories of psychology and education according to which education is regarded as a matter primarily of habit-formation; that is, developing in the individual a repertory of specific responses to situations, so that he has a ready reaction to situations as they arise. Now, as already suggested, although habits are desirable and economical—in fact, at times essential—if they were the principal ends of education, they would compel us to live always in the past; there would be no such thing as new, spontaneous, and insightful adjustments. We should first have to go through a process of training to establish a habit—a fixed response—for every conceivable situation. That, obviously, is not the manner in which the human organism—nor the infrahuman organism—adjusts and responds to new situations. Education and the development of behavior are more than a matter of habit-formation; for, in addition to certain desirable habits and skills, education should cultivate thinking, reasoning, and reflection which will help define a situation and problem and to make the particular response appropriate to the particular occasion. This, in general, is what is meant by adjustment.

The person who has a fixed repertory of habits upon which he must rely at all times is incapable of meeting new situations. In fact, degrees of flexibility and rigidity of behavior are associated with degrees of intelligence and age. In the mentally deficient, for example, it is desirable to establish as many useful habits of action as possible; for their

inadequate intelligence makes them incapable of weighing new materials and gaining new insights as they arise. In other words, since the mentally deficient are decidedly limited in their ability to acquire new and more or less subtly varying ways of acting, it is necessary to provide them with the best possible set of habits they are capable of mastering. But normal and superior individuals are not so limited; thus habit-formation should be of less significance in their education. It has been found, also, that in adulthood, particularly in the later stages, variation of behavior, new kinds of adjustments, are more difficult of attainment than in childhood and adolescence. This condition, however, is the result of a loss of physiological plasticity, repetition of acts over a much longer period, actual cessation of continued and challenging mental activity after the period of formal schooling, and an actual unwillingness to abandon the feeling of ease and security that attends habitual ways of behaving.

Breaking Habits. Undesirable habits may develop just as well as desirable and useful ones. Methods of breaking the former kind are therefore essential, particularly in the educative process where it is necessary to substitute one of the latter type.

In the first place, a habit might disappear through disuse. But such disappearance is improbable unless the individual's environment is changed sufficiently so that the particular habit is not evoked. Such change, however, is difficult in most instances and impossible in some.

The mere desire or will to unlearn is not enough to break an undesirable habit. Some active effort and counter-activity is necessary. This counter-habit should be as positive and satisfying as possible for the individual concerned. There must be a felt need of a change on the part of this individual. The change must be accepted by him as *his own* new mode of behavior rather than being an act imposed from without by someone directing the remedy. Further-

more, once he accepts the new act, he must strive to attain a high order of performance. And, as William James said, a person who is trying to break an old habit and substitute a new one should never suffer an exception to occur until the new habit is securely rooted.

A unique method of breaking habits has been proposed by Dunlap.[7] Instead of accepting unqualifiedly the doctrine that repeating an act helps to strengthen it, he maintains that repetition will either strengthen or weaken it depending upon other factors in the total situation. Specifically, if repetition of the act produces unpleasantness and annoyance, and if a person hopes to eliminate the undesirable habit by actually *repeating that habit*, then, Dunlap holds, the undesirable habit can be broken by repeating it. He experimented with his own habit of writing "hte" instead of "the" on the typewriter. He purposely wrote "hte" several hundred times, always with a strong awareness that this was an error and that it should not be repeated in the future; after which he found that he wrote "the" correctly in his ordinary typewriting. He tried, with preliminary success, the same method in curing a boy's habit of stuttering; the procedure being to have the boy master *voluntary* stuttering which duplicates his involuntary stuttering as closely as possible. By this device, apparently, the boy achieved voluntary control over a behavior which previously had been beyond his control; and, presumably, this voluntary control is accompanied by a consciousness of mastery, with consequent satisfaction.

Dunlap's method has not yet been tried extensively in a great variety of activities. But should it be found a sound and universal principle, his method will not in effect necessitate a revision of any of the facts of habit, nor of what has been said about habit breaking. In the first place, though the wrong or undesirable habit is repeated willfully, the new

[7] Dunlap, K., "A Revision of the Fundamental Law of Habit Formation," *Science*, vol. 67, 1928, pp. 360-62.

and desirable form of behavior is being used and established. And, second, by bringing the undesirable act under voluntary and conscious control, *it ceases to be a habit;* for one of the essentials of habit is its automatic character, since it is no longer the focus of behavior. Thus, when a form of behavior is made a matter of voluntary control, it may or may not be carried out, depending upon the person's choice. It will be interesting and significant to learn whether such undesirable habits as nail-biting, tics, manner of talking, temper outbursts, etc., can be brought under control through the use of Dunlap's method. In the meanwhile, employment of the methods for breaking habits, previously indicated, should prove useful.

Repetition as a Factor in Learning. There are certain factors which affect all types of learning: some types more, others less. The first of the factors to be considered is *repetition.* The old adage that "Practice makes perfect" must be significantly qualified, because frequent repetition of an act cannot *of itself* account for the learning of that act. In other words, sheer repetition will not bring about learning. In some types of learning, as in the acquisition of skill, what repetition does, principally, is to provide opportunities and furnish conditions which are favorable to the discovery and selection of the correct response. In other types of learning, repetition provides opportunities for the greater apprehension of details, meanings, and relationships which may not be apparent at first. Re-reading poetry and prose of all kinds, viewing moving or still pictures more than once, and re-hearing selections of music are cases in point. Repeated contacts with these, and others as well, enrich the perceived materials so that learning is fuller, more effective, and more lasting because more meaningful.

In fact, no two repetitions, no two instances of behavior, are exactly alike in all respects, although after an act has been well fixed the differences may be very minute. An individual, therefore, does not actually repeat the same re

sponse from one trial to another. But what he does repeat is the goal-activity, whereby he attempts repeatedly to attain a given goal, towards which he strives until an adequate level of achievement has been reached. If learning by repetition meant simply repeating acts previously made, no one would advance beyond the erroneous, clumsy, and awkward efforts of early trials. For example, if learning proceeded by sheer repetition, it would follow that a child could never overcome the scrawls of his first attempts to write. Repetition for him would amount to the acquisition of facility in illegible writing. Improvement in a skill of this kind through practice consists, instead, in the elimination of irrelevant details and in the retention of the relevant. Furthermore, the learner must understand the goal in a manner that is adequate to himself and to his way of doing things. Often a child's apparent inability to learn in spite of drill and repetition is attributable to the fact that he does not apprehend what is to be done; nor why. Consequently, the situation does not have, for him, the directiveness of a perceived goal; nor is the behavior stimulated by a felt need or desire on the part of the child himself.

The secondary rôle of repetition is shown also in experiments on learning of a complex nature, as demonstrated by the following.* A tuning fork was sounded near the web of a spider. To this disturbance the spider made its characteristic defense response of dropping on its thread. The fork was sounded at intervals, each time after the spider had returned to its web. Eventually, the spider ignored the sound and remained in its web without dropping. Thus, despite the repetition of the stimulus (sounding of the tuning fork), the defense movement was not made because, since there was no danger, it was irrelevant. If, however, mere repetition of an act fixed behavior, we should have expected the spider to continue making the defense movement more

* Peckham, G. W., and E. G., "Some Observations on the Mental Processes of Spiders," *Journal of Morphology*, vol. 1, 1887, pp. 383-419.

readily with each successive sounding of the tuning fork. Further, in connection with complex learning, we may recall the experiments with apes and children in which learning was achieved through insight, whereas repetition played a decidedly minor part, if any.

The Peckhams' observations on the spider were made more than fifty years ago. But a quotation from a very recent report will show that contemporary experiments are in essential agreement with this older one as regards the rôle of repetition. Peterson writes: [9]

> . . . it was clear that the animals had largely disregarded the association laws which philosophers and psychologists had built up through the ages since the time of the early Greek scholars. One could hardly have predicted at any point what a given choice would be. Moreover, it was found that in the early stages of the learning, *reactions contrary to the expectations based on frequency* and recency factors were more numerous than reactions in accordance with them. [Italics ours.] . . . In many cases . . . the influence of these factors is against learning, other factors having to throw the responses out of the frequency-recency channels.

One might very properly ask whether there are not some types of learning which can be achieved only through and by virtue of repetition. We have already stated how repetitions may promote the acquisition of motor skills and the learning of meaningful materials. But what about materials that are not inherently meaningful, like nonsense syllables; or materials whose meanings are rather obscure, like the multiplication table or the alphabet? The fact is that materials of these latter types are acquired with difficulty and after many more repetitions than are necessary for meaningful materials of the same length.[10] Repetition, therefore, is obviously important in these and similar instances. But it

[9] Peterson, J., "Aspects of Learning," *Psychological Review*, vol. 42, 1935, pp. 1-27.

[10] A striking illustration of this fact is furnished by data previously cited: namely, the case of the psychologists—Ebbinghaus and Meumann—who re-

is not repetition alone that counts; for experiments have shown that individuals trying to memorize nonsense syllables attempt to develop some sort of rhythm or cadence; or some sorts of combinations. That is to say, they seek in the course of repetitions to give the nonsense syllables some kind of form or arrangement which will facilitate their acquisition. Thus, if the intended learner is actively trying to put the materials into a pattern, repetitions will afford him opportunities to discover the most effective procedures. When a child acquires the alphabet in the proper sequence of letters, he does so best, as all know, when it is put into a rhyme. When a very young child learns the letters of the alphabet on toy blocks or in connection with other such objects, he is, to be sure, acquiring an arbitrary name for a visual pattern which is a letter (say, H, R, or any other one): but the acquisition is very slow, accompanied by error and confusion, and in need of regular reinforcing through continued experience. Slowly the characteristics of the various letters emerge and are identified, through repeated contact. But it should be noted that the more effective devices used to teach young children the letters employ pictures or little rhymes, for example, each letter having its own setting, of which it is a part.

It is also well known that the multiplication table and the fundamental arithmetical processes are laboriously and uncertainly acquired by the method of sheer repetition, as often taught in the earliest school grades. On the other hand, it has been shown that if the fundamental processes of arithmetic are acquired functionally—that is, through actual situations requiring their use—they are more readily learned and better retained. In the study of arithmetic, the relative ineffectiveness of rote or mechanical drill (which is

quired 55 and 33 repetitions, respectively, to memorize a series of only 36 nonsense syllables. Yet the subjects of another experiment were able to memorize passages of poetry containing 60 *words* in but 6 repetitions; while passages of 750 *words* required 19 repetitions, and those of 1500 *words* needed 26.

but repetition), and its uneconomical character, are well shown in the following experiment. For an experimental group of elementary school children, formal instruction in arithmetic was postponed until the beginning of the sixth grade, instead of having been begun in the second half of the third, as was the case with all other children. The experimental group did, however, carry on many functional and informational activities related to quantitative thinking prior to the sixth grade. At the beginning of the year in grade six, the pupils in the experimental group compared unfavorably with traditionally drilled pupils in tests of the four fundamental processes of arithmetic. But by the middle of the following April, *all* pupils were on a par.[11] Thus, the experimental children in less than one year had attained a level of achievement which the traditionally drilled children had reached in nearly three and a half years. The facts that emerge significantly from this experiment are: that functional learning is most effective at first, and that drill

[11] Benezet, L. P., "The Story of an Experiment," *Journal of the National Education Association*, November, 1935, pp. 241-244.

Initially the learning of difficult and relatively meaningless materials is assisted by functional reinforcement, such as rhymes with the alphabet and informational activities with numbers. But later, steps should be taken to insure that the alphabet and the numerical relationships become abstract. That is, the pupil should eventually be able to say the alphabet without rhymes and perceive numerical relationships without specific qualifications of a concrete kind. Teaching in progressive or "activity" schools sometimes falls down in regard to the second, the abstract, stage. This it need not do if it will recognize the place of abstraction and introduce it after familiarizing the pupil with arithmetic through informational activities. One freshman, in a college of engineering, a product of an activity school, was still unable to treat numerical relationships abstractly. He had learned to divide by thinking of a matchstick being broken into parts. In grade school, he had started to learn division by actually breaking up a matchstick, and nothing had subsequently been done to enable him to perform the simplest arithmetical operation abstractly. Now in college, when he divided he still broke up matchsticks imaginally. This slowed him down so much that he became a "problem case." What could he do, for example, if he had to divide 56 by 17, or $\frac{15}{99}$ by $\frac{23}{85}$? This note is not to be taken as a rejection of "learning by doing," nor of the soundness of the activity principle. It simply calls attention to the fact that teaching should insure the development of ability to deal with abstractions wherever necessary.

and training are most effective when the intended learner is at the proper level of maturity. And being at a proper level of maturity means, among other things, being able to understand and profit from what is revealed to the learner by repetition: rhythms, forms, organization, meanings, relationships, uses, etc.

We may conclude, then, that in some activities repetition is more important than in others; that repetition's rôle is a secondary one; and that the efficacy of repetition is dependent upon the functional character of the task, the intended learner's level of skill or learning, his level of maturation, and his purpose.

Precision as a Factor in Learning. Precision is really a consequence of repetition under proper and favorable circumstances. It is, however, sufficiently significant to warrant independent consideration. The term means that all observed situations, data, and behavior undergo change in the direction of more stabilized forms. There are certain objects in the environment which, because of their very character, are "favored forms" and remain quite stable. Such, for example, is the circle which is the first of the geometric figures the child apprehends and deals with correctly. Other "favored forms" are common objects such as dogs, tables, chairs, persons, familiar names, etc. In other words, these and others like them have become rather well-fixed "pieces" in the furnishings of the child's and adult's environment. They have achieved a definite character either by virtue of their intrinsic properties, as in the case of the circle, or by virtue of repeated functionally significant contacts and perceptions. Common objects, such as the dog and the cat, blocks and chairs, etc., become favored forms because of their frequent presence, their motion and sudden sounds (as in the case of the animals) experienced by the young child, and because of manipulation and curiosity exercised by the child upon familiar objects in the environment (as in the case of blocks).

In bodily movements, also, the same principle is at work, as should be evident from the discussion of skill and repetition. Irrelevant and ineffective movements drop away, and *the performance develops in the direction of the most efficient and most economical actions.*

In many instances, however, there are no "favored forms." What becomes precise and stabilized, therefore, will be in part a matter of what is actually emphasized in the early experiences with the situations or materials, thereby increasing the vividness of the experiences. Thus, in the teaching of arithmetic, say, the processes should be so presented as to make emphatic those aspects upon which intelligent arithmetical operations depend. In teaching history, or science, or anything else, the details should be subordinated and the significant aspects and principles emphasized. These, then, will tend to persist and become more definite and emphatic. Finally, when the limit of definiteness is reached, that form of the perception or action becomes relatively stable. Unless learning proceeds in a manner that encourages the emphasis and stability of certain aspects rather than others, the intended learner fumbles about indefinitely and uneconomically.

Primacy as a Factor in Learning. First impressions are stronger than subsequent impressions of the same situation. In learning, therefore, it is highly desirable that the correct responses should be emphasized and established from the earliest stages. If the first responses are fumbling, or if the first impressions of a new subject of study are incorrectly apprehended, the errors of response or the distorted impressions may be serious obstacles to later learning. It is obviously more economical to begin learning with proper responses than it is to develop errors which later must be overcome before the correct responses or impressions can be satisfactorily established. Sound educational procedure, therefore, will see to it that the first steps taken in any learning situation are the desired ones, and that new learning

materials are so presented that there emerge readily those facts, principles, processes, organizations, and attitudes which it is desired to have emerge.

Because first impressions and experiences are stronger than subsequent ones, the period of childhood, when original experiences are most numerous and frequent, is extremely important in the development of attitudes toward people, institutions, subjects of study, superstitions, and the school itself. It is because of the training received throughout childhood that persons often carry with them through all or most of life certain social, religious, sexual, political, and even intellectual attitudes. Adults, also, are affected by the primacy of an experience or impression. Everyone knows how difficult it is to overcome a first impression of a person, or a city, or a book, a play, a piece of music, a subject of study, etc. Primacy, therefore, as a factor in learning, is important not only in facilitating or impeding the acquisition of knowledge or skill, but also in contributing to the development of permanent or semi-permanent aspects of an individual's personality.

Recency as a Factor in Learning. Other things being equal, recent perceptions are more readily recalled than those which are remote. An exception to this, apparently, is the forgetfulness of very old age when recent experiences and perceptions make but a superficial impression, whereas some impressions of youth are at times recalled with a remarkable semblance to reality. However, when this phenomenon of old age is viewed in the light of primacy and other considerations to be presented it will not appear so exceptional.

Physiological explanations (so-called) of recency as a learning factor are thus far only unproved hypotheses; and they fail entirely to explain the apparent exception already mentioned, just as they fail also to explain why even in the case of younger adults, adolescents, and children some events more remote in time are better recalled and utilized than

other less remote events. For instance, a child will recall the events of a party held some days or weeks ago, whereas events of the preceding day will have faded. The student will remember his first day at college, whereas he may not recall details only a few days old.

Nor do we have certain and demonstrated psychological explanations of this mental phenomenon. Nevertheless, the two following hypotheses are plausible. Recent perceptions are recalled more readily, other things being equal, because the purposes for remembering them have not been weakened or have not disappeared as a result of other competing purposes. This, in other words, puts the emphasis upon the strength of motive and incentive in behavior. Related to this hypothesis, but somewhat different from it, is a second possibility: namely, that, more likely than not, recent events and perceptions have greater functional value for the individual than do the more remote ones; which means that the recent perceptions are more likely to enter into the organization of and be relevant to our present situations than are those remote in time.

However, regardless of the physiological and psychological hypotheses, the fact is that recency is a condition of learning. That being the case, it has some bearing on the educative process. It suggests, first, the desirability of proper continuity in the organization and presentation of materials, as well as in the sequence of courses of study. It suggests, in the second place, the desirability of learning in a setting wherein, so far as possible, the behavior or information to be learned is actually operative from time to time, and also relevant.

Exceptions to the recency factor have already been mentioned. But it must be noted that recency will be effective as a factor if others do not combine to overcome it. Indeed, in considering the rôle of any factor in a particular learning situation, it is essential to take into account not only the factors themselves, but their relative strengths. A strong first impression (primacy), for example, especially if strongly

colored by emotion, might be more powerful in recall and future behavior than much later perceptions. The probability is that in old age the recollections of youth owe their existence and vividness to the fact that they were original perceptions and experiences, often possessing a high degree of novelty, very significant at the time experienced, and, therefore, having a marked emotional content.

Organization as a Factor in Learning. The ease of acquiring information and concepts will depend in part upon the degree of meaning they have for the learner and upon how well they are organized into useful, or functional, patterns. This means, in effect, that we must reject the classical doctrine of association which states that the mere fact that two or more things happen together a sufficient number of times will account for one of these things recalling the others on a later occasion. Thus, if *A*, *B* and *C* have occurred together, then, according to this classical but no longer acceptable doctrine, if *A* occurs later, it will call up *B*, and *B* will call up *C*. We may illustrate the error of this association doctrine by calling attention to such common objects (and their words) like "knife," "pencil," and "tree." The first of these usually calls up "cut" or "fork" because these are members of a functional unit in eating. "Knife" does not ordinarily bring to mind "water" or "table cloth," in spite of the fact that these last have been together with "knife" on innumerable occasions. Similarly, "tree" will not suggest "sunshine," unless the individual happens to be studying the influence of the latter upon the former. Many other such instances of the failure of association by contiguity only can be found. Where association does take place, it does so not because of sheer contiguity in time and space, but because the objects, concepts, information, or what not, have previously been perceived as members of an organized and meaningful whole. This is what is meant by organization.

There are many experiments and data which bear on this factor of organization and meaning. For example, in one

instance the experimenter read to his subjects several series of disconnected words varying in length from four to 18 words each. He also read to them a series of sentences varying in length from eight to 34 words each. After hearing each series read but once, the subjects wrote down all they could recall. The average number of disconnected words recalled was 6.5; whereas in the case of sentences the average was 18.3. This very significant difference is attributable to the presence of organization and meaning in the sentences and to the relative absence thereof in the series of disconnected words.

The same principle was demonstrated when the subjects of the experiment were required to reproduce not the exact words of a passage, but the ideas instead. For this purpose, the experimenter read aloud to his subjects first a simple, readily comprehended story called "The Marble Statue," after which they were required to write out all they could remember. This was followed by a selection of equal length from Hume's philosophical writings. Each passage had 67 ideas. The average number of ideas reproduced for the former was 49, whereas for the Hume passage the average was 11.5. A week later, and without previous notice, the subjects were required again to reproduce the materials of both passages. The averages then were 56 and 3.75, respectively.[12]

The reason for these great discrepancies will be readily apparent to anyone who will select a typical passage from Hume and compare it with a simple prose passage. For the vast majority of persons, the facts, events, concepts, and terms used in "The Marble Statue" are within their range of apprehension and are meaningful. They can, so to speak, assimilate these facts, events, concepts, and terms because of their own previous experiences and responses, and because of their own present level of ability. The Hume passage,

[12] Reed, H. B., *Psychology of Elementary School Subjects*, Boston, Ginn, 1938, pp. 6-7.

by contrast, does not find, in most persons, any such favorable background. Naturally, then, since organization is a most significant factor in learning, it is essential, if learning is to be most effective, that materials to be learned should be so graded in difficulty as to be commensurate with the individual's mental level, his background of experience, and the tools he has available, such as vocabulary, number concepts, and specific information.

We may conclude that when a number of objects or ideas are organized into a pattern, or a whole, they are held together by virtue of their membership in that whole.* Later, when a member, or part, of this whole is re-experienced in an appropriate situation, it will tend to reconstruct the original whole. To promote organization and consequent learning, many devices and procedures may be used. The problem should be clearly stated; the learner should be told what to look for and to expect; the goal should be clearly defined so that each step is seen in relation to the whole; illustrations and concrete first-hand experiences should be employed; vocabulary and other symbols employed should be within the learner's comprehension.

Visual Aids in Learning. The best way to learn is to make the learning activity involve as many kinds of sensory experiences as possible. This fact is one of the justifications of educational devices such as laboratory practice, excursions, museum trips, etc.[13] But there are some subjects of study that do not lend themselves to direct experiences or first-hand contacts; while in other instances such are not feasible. Yet even in these instances visual aids of another sort can be employed effectively, as demonstrated in an experiment using sound motion pictures in general science instruction.[14] The pupils used in the experiment were in

[13] See Hoban, C. F., Hoban, C. F., Jr., and Zisman, S. B., *Visualizing the Curriculum*, New York, Cordon, 1937. This book presents the various methods that can be employed.

[14] Rulon, P. J., *The Sound Motion Picture in Science Teaching*, Cambridge, Harvard University Press, 1933.

the ninth grade. Two groups, the control and the experimental, were given instruction in general science, as nearly identical as possible, with the exception that the experimental group's instruction was supplemented by sound motion picture films dealing only with topics in the textbook. But the total time spent on the films and textbook in combination was the same as the time spent on the textbook alone by the control group. Thus if any differences in learning were revealed between the groups, they would be attributable to differences in instructional method.

The results of this experiment showed unequivocally that the employment of motion pictures was more effective in respect to facts acquired and remembered, general grasp of subject matter, and ability to apply the materials acquired. In tests given immediately after the presentation of materials, those who had the motion picture experience (experimental group) were at least 10 percent superior to the group that had not (control group). In tests given three and a half months later, the experimental group were even more superior, surpassing the control by more than 20 percent. The former, therefore, learned better and retained better.[19] The motion picture showed its greatest effectiveness when it aimed directly at the instructional program and presented *specifically* those facts and relationships which it was desired the pupils should learn and remember: for in these specific materials the experimental group's superiority was 55 percent.

It is to be observed that the motion picture is used as a point of departure and in connection with the usual classroom procedure. It is not a substitute to displace the usual teaching procedures. Specifically, the advantages of the motion picture are that it creates more durable impressions, it provides clarity of presentation, and it furnishes clues by

[19] The author of this investigation maintains that his statistical results are such as to indicate that an indefinite number of repetitions of this experiment would show the true advantage of the experimental group to be about twice the percentages cited above.

which subject matter may be better understood and longer retained. In general, this experiment and a number of others similar to it show that learning is more effective when it involves different kinds of sensory experience.

Pleasantness and Unpleasantness as Factors in Learning. Feelings of pleasantness and unpleasantness (called affective states) are significant conditions of learning. We have already stated that in a true learning situation, where the individual has an interest and a goal, he experiences a felt need; and his learning is thus properly motivated, the intensity of effort and efficiency of learning being dependent to a significant degree on the strength of the motive. The affective states are the means whereby the individual is made aware of the results of his behavior in terms of feelings, and in terms of the influence of his behavior upon his felt needs and tensions. Most biologists and psychologists are agreed that affective experiences (feelings) rest essentially upon basic physiological processes which are aspects of behavior. Therefore, as Prescott asserts, "If this be true, then affect plays an extremely important rôle in human life and all the nonsense about the desirability of suppressing or eliminating it should be disposed of once and for all." [16] In respect to learning this means that any true and, therefore, significant learning situation is attended by facilitating or inhibiting feelings of varying degrees of intensity. Now, although psychological experiment has as yet certainly not fully revealed the exact relationships existing between learning and feelings, enough evidence is available to warrant certain conclusions.

In this connection, most experiments have been performed with animals, although there are some dealing with humans. For example, hungry white rats are put into a maze which they must learn to traverse in order to get food at the exit. It was found that the intensity of the motive

[16] Prescott, D. A., *Emotion and the Educative Process*, Washington, American Council on Education, 1938, p. 50.

(in this case, hunger) and the possibility of its satisfaction after learning the maze resulted in the most rapid learning. It has been shown, also with rats, that the simultaneous presence of more than one motive produced more rapid learning than did only one motive. Thus it appears that the speed and effectiveness of learning of these animals were correlated with the number and strength of the motives involved.

In the case of human subjects, most of the experiments have dealt with the effects upon learning produced by feelings resulting from praise, reproof, knowledge of success, knowledge of failure, and punishment during learning. In general, as one might well expect, a knowledge of failure produces in a person feelings which are less favorable to subsequent learning than a knowledge of success in a previous performance. The same results are obtained when knowledge of success or failure is accompanied by praise or reproof from the teacher or experimenter.

In other experiments—largely with animals, and to some extent with human beings—the subjects were punished (by means of an electric shock) for wrong responses; or, in the case of human beings, they were in some instances threatened with punishment for wrong responses, while in others they were continuously praised or reproved in the course of their activity. These experiments showed that punishment or adverse criticism will increase the rate and efficiency of learning, *provided such punishment and criticism do not produce unpleasant feelings beyond the point of critical intensity*. That is to say, a feeling of mild unpleasantness will facilitate subsequent learning, whereas an intense feeling of unpleasantness will inhibit learning. In the latter case, the strength of the punishment is sufficient to overcome the strength of the motive, with the result that further learning is inhibited. As a corollary of this, it may be said that the amount and intensity of punishment and reproof that will be endured, will depend upon the affective state produced

in the learner by the motive or motives present in the situation; that is, by the strength of his felt needs. One can find numerous instances to illustrate this corollary: the dangers and hardships that persons will endure, in fact will invite, to achieve certain ends held in high esteem, or biologically necessary for survival or for physiological equilibrium. On the other hand, many instances can also be found wherein the individual does not feel that the goal to be achieved is worth the punishment and unpleasantness that must be endured in the course of the learning activity. This again emphasizes the fact that we must take into account the entire situation with all its interplay of forces if we are to understand a person's behavior. It is not enough to know the intensity of the feeling of pleasantness or unpleasantness; but we must also know the motive and its goal, the nature and complexity of the thing to be learned, and the presence or absence of conflicting interests and goals.

The principle of feeling-intensity applies to the *recall* of materials previously learned: for recall of materials associated with very unpleasant feelings is often inhibited in spite of the fact that they had been acquired previously.

These experimental findings in respect to the rôles of the affective states of pleasantness and unpleasantness in learning suggest, as Prescott states, ". . . that the problem of education in dealing with emotion is less that of suppression and rigid regulation and more that of organizing conditions to minimize violent reaction and to provide opportunities for the reasonable working through of vital energies." [17] In other words, strong emotional behavior should not be allowed to dominate a learning-situation; nor should the situation be one of affectional indifference and neutrality. Instead, a moderate affective state of pleasantness or unpleasantness is desirable, for such states are the psychological evidences of behavior that is deeply rooted and useful.

[17] *Op. cit.*, p. 59.

Transfer of Learning. A problem of importance in learning, and of particular importance to educators, is whether training of a specific kind will in general carry over, or transfer, to other mental activities. To put it specifically: can any one subject, say mathematics, or science, or law, train one's ability to reason *in general?* Does the learning of dates or of a foreign language improve one's memory in general? Similarly, does the training of a mental process—such as imagination or observation—by whatever means, carry over to all varieties of situations in which this process is involved? In other words, does training of given mental processes on particular materials and by particular exercises so improve those processes that the individual's performance is improved in all situations where these mental activities are called for?

In 1890 the principle involved in the foregoing questions was put to the test by William James, as reported in his *Principles of Psychology*. He tested his own memory by memorizing 158 lines of poetry from Victor Hugo's *Satyr*, requiring a total of 132 minutes, distributed over eight consecutive days. Then he exercised his memory on the first book of Milton's *Paradise Lost*, memorizing 20 minutes a day for 38 days. After this period of drill, he returned to Hugo's *Satyr*, memorizing another 158 lines in the same way as the first time. Now, the point is that if *mere* exercise improved the memory, James should have required less time for the memorization of the second passage from Hugo than he did for the first. In fact, however, he needed 151 minutes as against the original 132. James himself attributed the increased time to his being fatigued. Because of his fatigue, this historically important experiment is not as unequivocal as it might have been. But he induced other persons to perform a similar test on themselves; and they obtained practically the same results.

Since that time, methods of studying transfer effects have improved, and numerous data have been gathered with a

variety of materials. Persons were given practice in estimating size and weight of various objects; then they were required to estimate size and weight of other objects. Subjects were drilled to observe words containing certain letters (*e* and *s*), after which they were tested to see whether there was an improvement in their ability to observe words containing other selected letters, such as *i* and *t*. Another experimenter trained both human and animal subjects to find a pathway through a maze with a view to determining whether this training aided or hindered in finding pathways through several other mazes. Both these experiments showed that there was some positive transfer effect, the degree of transfer apparently varying with the degree of similarity between the two tasks. In fact, it was concluded also that at times practice in one task may injure one's performance in another which is even called by the same name. That is to say, for example, practice in tracing the path of one kind of maze can be a handicap in finding the path through another maze of a quite different plan. Interference through transfer, such as this, is at times also found in other activities, as in spelling, when rules are applied to "exceptions," or when attitudes, habits, or procedures are applied where irrelevant or inappropriate.

Much more important than the foregoing types of sensory and motor experiments are those involving the higher and more complex mental processes, such as memory, reasoning, and attitudes. Like James, many psychologists have studied memory training. Their detailed results vary; but they all show either no transfer effect or relatively small transfer. What transfer effect there is, may very probably be attributed to improvement of one's methods of memorizing and to the development of efficient techniques rather than to a generalized "strengthening" of the memory, in the way a person strengthens his muscles by exercise.

In the educative process, even more important than experiments on memory are those dealing with the alleged

superior training-value of certain selected subjects of study, such as Latin and grammar. In general, it has been shown that the study of grammar has little beneficial effect upon ability to use language, and that whereas the study of a foreign language increases pupil's knowledge of English grammar, it only slightly influences English usage. High school pupils who study Latin gain more in their knowledge of English words of Latin origin than do pupils who have not studied Latin. Pupils who study Latin gain more in reading ability than do non-Latin pupils; they are somewhat superior in their spelling of English words of Latin origin, but not in their spelling of words of non-Latin origin. One investigator found that training children in solving arithmetical problems gave them, in later tests of logical reasoning, an advantage of thirty percent over a corresponding group of children who did not have such training.

The most comprehensive investigation of the transfer of learning was carried out by E. L. Thorndike with more than 8500 high school pupils.[18] His object was to evaluate and compare the amount of transfer or gain attributable to the study of the different subjects in the high school curriculum. His resulting data showed that part of the pupils' mental growth at even the high school level is attributable to the intellectual activity involved in the study of secondary school subjects. But although there were differences in the amount of growth contributed by each of the several subjects, Thorndike is disposed to discount these differences. Instead, as a consequence of his elaborate analysis, he concluded that, "By any reasonable interpretation of the results, the intellectual values of studies should be determined largely by the special information, habits, interests, attitudes, and ideals which they demonstrably produce. The expectation of any large difference in general improvement of the mind from one study rather than another seems doomed to

[18] "Mental Discipline in High School Studies," *Journal of Educational Psychology*, vol. 15, 1924, 1-22, 85-98.

disappointment." Furthermore, whatever transfer or gain takes place is dependent much more upon the pupils' initial mental abilities than upon the particular subjects studied. For example, the highest one percent of pupils in initial ability gained about 14 times as much as the lowest one percent in the course of a year, as measured by psychological tests of some of the more complex mental processes. In other words, as regards general transfer it is not so much a matter of *what* is studied as it is *who* studies, although *all* profit to a degree.

Considering the available experimental evidence, we may conclude that *some* positive transfer does take place, as shown by P. T. Orata's statistics summarizing the results of experiments from 1890 to 1935. He found that 28 percent of the studies showed considerable transfer, 48 percent appreciable transfer, 9 percent very little, 3.6 percent none, 7.2 percent transfer and interference, and 3 percent interference.[19] The degree of transfer, however, as shown by these studies, varies from very slight to very appreciable amounts.

It is not to be assumed, however, that the transfer which does take place is the automatic result of having studied a particular subject. It has already been stated that the learner's intelligence is a factor in the determination of how much transfer effect there is to be. Other factors beyond the subject of study itself also enter. These other factors are the *conditions* under which the experiment takes place or under which learning proceeds. It has been demonstrated experimentally that emphasis upon *methods* of memorizing will increase a person's ability to memorize, whereas sheer exercise in committing materials to memory will not do so. In one of the experiments, the group of subjects receiving instruction in the *technique* and *process* of defining words made very appreciable progress in defining words in general, whereas a group receiving routine training in word

[19] "Transfer of Training and Educational Pseudo-Science," *The Mathematics Teacher*, vol. 28, 1935, p. 267.

definition profited but little. It has been shown, also, that pupils' knowledge of English words having Latin origin can be markedly increased by focusing upon this aspect of instruction in Latin; whereas ordinary familiarity with Latin by the usual methods of instruction was only about half as effective, so far as effect upon a knowledge of English words is concerned.

The foregoing results signify that if the maximum transfer effect is to be achieved, it is necessary that the relevant methods of learning and doing and that the general principles involved in the situation be made explicit and emphasized. It is possible that at least part of the subjects' differences in transfer value found by Thorndike, in the study already mentioned, were attributable to differences in methods of instruction used and to conditions of learning, some favoring transfer more than others. Mere acquisition of details or exercise and repetition will not suffice if the maximum training value of a subject of study is to be attained. This conclusion has been further substantiated by experiments with school children in learning arithmetic in which generalization and understanding of basic principles were taught rather than the bare facts and mechanical processes. Similarly, transfer is facilitated when learners are made aware of and alert to the possibilities of its taking place, this in turn being in part dependent upon the learners' interest and motivation.

Finally, it can be said that the foregoing principles and conditions apply equally to the transfer or generalization of attitudes and ideals. These will not readily nor necessarily emerge of themselves from materials being studied; nor will the learner necessarily make appropriate applications to other and new situations; although the extent to which he does so spontaneously will depend in part upon his intelligence. Children have been taught neatness in connection with their papers in arithmetic; but until neatness as a general ideal was made explicit and applied, there was no effect

upon their papers other than those in arithmetic. The same is true of social ideals and attitudes, especially in the earlier phases of learning.

The educational implications of these results are clear. The importance of *methods* of teaching is at once apparent if the educative process is to achieve more than a mere amassing of information, to be temporarily retained. If, then, transfer is to take place, if learning is to be generalized and to have contingent value, the conditions affecting transfer must be deliberately provided, and transfer effect must be made an explicit objective in the teaching of the subject.

Thus far in our discussion, we have been concerned with the facts of transfer; they are rather definite and of distinctly practical value. The psychological *theories*, on the other hand, are quite another matter; for they are but hypotheses, and there is sharp disagreement. However, these differences in theory do not in any way invalidate the experimental facts nor the practical significance thereof.

Two theories of transfer having considerable currency, and standing in opposition, are: (1) the theory of identical elements; and (2) the theory of generalization. According to the first of these, transfer effects take place only in so far as one situation or task has elements which are identical with the other. Such is the case when the study of Latin improves one's knowledge of English words of Latin origin; or when the study of Latin grammar improves one's learning of English grammar. According to the second theory, transfer takes place because experiences and learning are generalized. Their essential characteristics, form, organization, principles, and the like are perceived and abstracted, after which they can be applied in other situations. No two situations need be identical for transfer to take place; the previous learning can cover a wide territory. Identical elements may be few or entirely lacking, so far as details go; but previously learned principles may still be applicable. Thus transfer effects will be afforded by forms of learning

and behavior which will be called for at different times and in different situations. In this connection, cases in point are the transfer of attitudes, ideals, and ways of acting. It therefore appears that to some of the experimental results the theory of identical elements is applicable, while to others the theory of generalization applies; the one emphasizing identity of details, the other general similarity of situations.

Measurement of School Learning. It is the schools' function to bring about certain desired results in their pupils in respect to the development of attitudes and personality, the acquisition of knowledge, and the development of skills. Personality and its measurement were discussed in an earlier chapter. Attitudes are discussed in a later chapter. It is our purpose now to present briefly the methods of measuring outcomes of instruction in school subjects in the matters of knowledge and skills.

Obviously, it is necessary to know how well pupils have progressed in learning. For this purpose the subjective judgments and "marks" of teachers have proved to be much less reliable than results obtained with *standardized objective* tests, although subjective judgments and marks have not been entirely supplanted. The value of objective tests resides in their *objectivity*, their *wide sampling* of materials, and their *norms*.

These tests are objective because little or no personal judgment is involved in their marking or scoring, and because writing on the part of the pupil is reduced to a minimum, being at times practically eliminated. The following specimens of types of items used make this clear.

Multiple-choice type: Each item usually has four or five possible answers. The pupil selects the correct answer and puts its number in the parentheses at the right.

Macbeth is

1. a comedy of youthful love
2. an English King
3. a tragedy of personal ambition

4. a historical romance
5. a story of warfare (3)[20]

True-False type: The pupil either underlines the correct word, as in the first statement; or he places a T or F after the statement, as in the second instance.

	True	False
Stevenson was the author of *Travels with a Donkey*.	( )	( )
Livy is famous as a Latin historian.	( )	( )

Completion type: The pupil supplies the correct word.

The author of *Hamlet* was ————.

Cross-out type: The pupil crosses out the wrong word.

He (lay laid) down on the sofa.

Matching type: In the right-hand list the pupil places after each title the number of the correct author, given in the left-hand column.

1. Jane Austen	*Life of Johnson*	( )
2. James Boswell	*David Copperfield*	( )
3. W. Shakespeare	*Macbeth*	( )
4. George Eliot		
5. Charles Dickens		

Rearrangement type: The pupil numbers the parts to show their correct sequence, as in the following when starting an automobile.

—— turn on ignition
—— shift gears to neutral
—— step on starter
—— open garage doors
—— release brake

These are the commonly used types, although they lend themselves to variations in details of form.

The foregoing are specimens of tests which measure information acquired. It is possible, however, to test objectively the pupil's ability to generalize, interpret, and apply materials studied. The following is an illustration: [21]

[20] This item is from *Typical Items*, Cooperative Test Service, New York, 1938.

[21] From Wrightstone, J. W., *Appraisal of Experimental High School Practices*, New York, Teachers College, Columbia University, 1936, p. 132.

In South Africa where the climate is quite dry, or arid, even stock raising is limited, although it is better suited to most of the country than farming. Rainfalls are few in the northwestern section of the United States. There is little agriculture in that region, and there, too, the land is used primarily for grazing. The semi-arid quality of the land in Arabia also is well suited to grazing. Explain: —

1. Trade equalizes the supply of goods in different parts of the world.
2. Agriculture is difficult in rugged regions.
3. The greater the area of a nation, the greater its economic independence.
4. Climate is an important determining factor in productiveness.
5. Arid lands are better suited to grazing than to agriculture.

The pupil is asked to place, after the word "Explain," above, the numbers of the generalizations which explain the facts of the paragraph. (In this instance: 2, 3, 5.)

There are also objective *scales* designed to evaluate the learning of skills such as handwriting, drawing, sewing, and the like. Each of these provides a series of specimens, experimentally evaluated and ordered, against which the pupil's product is compared and scored.

Finally, there are tests of skills in such occupations as those of machinist, carpenter, and plumber. These are called *trade tests*, being designed to test the competence of individuals who are ready to engage in a specified activity.

Whereas the ordinary essay type examination made out by the teacher tests only a limited sampling of the pupil's knowledge of a subject, the standardized objective test can, within a relatively short time, sample every phase by means of numerous items. The materials to be included in the test are selected with careful regard to the range of subject-matter and the weight to be given the various aspects. Furthermore, it is an established fact that wide sampling yields more accurate measurements, thereby giving a more nearly valid measure of the pupil's competence in the sub-

ject; for such sampling reduces or eliminates the element of chance which might favor one individual and handicap another.

A standardized objective test provides the average scores (norms) and range of scores which pupils of different grades and ages may be expected to attain. It is possible thereby to compare the competence of individuals and groups, and thus to evaluate the effectiveness of methods of study and instruction. In short, the availability of objective tests makes possible scientific study of learning under school conditions.[22]

The Rôle of the Nervous System in Learning. Not much is actually known regarding the way in which the nervous system works in the process of learning, although hypotheses are numerous. It is obvious, of course, that the learner must have sense organs with which to receive stimuli of the environment in which he lives, learns, and behaves.[23] These receiving organs, known as *receptors*, are classified under three headings. The first are *exteroceptors* which receive more or less distant stimuli (the visual, auditory, and olfactory organs), and those which receive external contact stimuli of touch, pressure, heat, cold, and pain (cutaneous sense organs). The second are *proprioceptors*, which are sense organs located in muscles, tendons, tendon sheaths, and joints, and whose stimuli result from movement of the body or its parts. These sense organs mediate the *kinesthetic* sensations attending movements of the members of the body which arise from stimulation of the receptors in the muscles, joints, and tendons. Also included in this second group are the organs of the ear which function in the maintenance of position and equilibrium (the semicircular canal, the saccule, and the utricle of the internal ear). The third

[22] Numerous books are available on the subject of objective tests and testing. See, for example, Greene, H. A., and Jorgensen, A. N., *The Use and Interpretation of Elementary School Tests*, New York, Longmans, Green, 1935; Hawkes, H. E., Lindquist, E. F., and Mann, C. R., *The Construction and Use of Achievement Examinations*, Boston, Houghton Mifflin, 1936.

[23] See also the chapter on Sensory Sources of Knowledge.

group constitute the *interoceptors*. These are the organs which operate within the body of the organism. They include organs of the digestive system (taste, smell, hunger, thirst, nausea), the circulatory, respiratory, and reproductive systems.

When a receptor is stimulated, according to theory, an impulse is initiated, traveling along the connected *afferent* (ingoing) nerves to the central nervous system (the spinal cord and brain). The impulse then proceeds through the connections of the central nervous system to the *efferent* (outgoing) nerves outward to muscles or glands which are activated. According to a rather common theory, it is the function of the central nervous system somehow to organize and switch about the impulses coming in by the afferent nerves and to send these impulses out by the proper efferent nerves to the motor centers of that part of the body which is to be activated. So goes the theory; and there are a number of hypotheses regarding the way in which the organizing and switching about are achieved.[24] But, as a matter of fact, the manner in which the incoming impulses are actually transformed into behavior is not known. What is known is that the receptors, the afferent and efferent nerves, and the central nervous system mediate and are necessary in learning and behavior.

Concerning the rôle of the brain in learning, somewhat more is known as a result of experiments performed on animals, particularly by Franz and Lashley. In their experiments, these investigators set out to determine which regions and how much of the brain cortex function in specific learned behaviors. Their method was to have the experimental animals learn a given activity, then by operation to destroy certain brain areas, and then to compare the animals' behavior before and after cortical destruction. In addition, comparisons were made between behavior of the animals

[24] Holt, E. B., *Animal Drive and the Learning Process*, New York, Holt, 1931, vol. 1.

operated upon and normal animals. For example, rats, cats, and monkeys, as the case may be, were trained to find their way through a maze, or to escape from enclosed boxes, or to go through other rather complex motor activities. After the performance had been learned, different parts and different amounts of the cortex—in different animals—were removed. After recovery, the animals were retested in the performances they had learned in order to ascertain the extent of loss in learning caused by the destruction of brain tissue. These same animals were then re-taught their former activities, their re-learning being compared with their original learning. Or, in other cases, in some animals the cortical tissue was destroyed *before* training, and their learning records were compared with those of normal animals.

The results of these experiments showed: (1) that the capacity to learn motor activities (for example, to get through a maze) is reduced by cortical destruction, the loss in learning ability being roughly proportional to the *extent* of brain destruction, but independent of the *location* of the area destroyed. (2) Retention of motor activity (maze running) after a period of delay (40 days) was markedly impaired by cerebral damage, the degree of impairment being dependent upon the amount of brain injury, as in (1) above. (3) The more complex the performance to be learned, the greater was the adverse effect upon learning which resulted from a given destruction. (4) Simple habits depending upon simple sensory perception (such as discrimination of brightness) are not greatly impaired by cerebral damage, even when the entire sensory area is involved.

These experiments are interesting and valuable in themselves; but for the purpose at hand—namely, the rôle of the nervous system in learning—they are most significant. They reveal the defects of the theory that *a special part* of the brain, and no other, operates as the center for various forms of learning, as in the acquisition and retention of sensory-motor activities. Instead, it appears that in learning there is

a widespread effect in the cerebrum. This means that learning cannot be explained in terms of fixed nerve-pathways, nor specific connections between nerves, nor fixed organization and structure in the brain. In this connection, we subscribe to the conclusion reached by an eminent neuropsychologist.[25]

> It is becoming more apparent that there are many factors working at one time, together or in opposition, and that the ability to carry out a learned [activity] is dependent upon the simultaneous and successive working of many parts of the cerebrum. . . . But the statement must not be interpreted to mean that every part of the cerebrum is used for every act of speech or for the understanding of every word a person hears or reads. Many parts of the cerebrum may be used for a mental process, but it does not seem likely that every part is used for every one. (Pp. 239-240.)

Hence the notion that the behaving organism is simply a rigid mechanism, with specific point for point relationships between situation, nerve and brain pathways, and behavior must be abandoned.

It is neither safe nor sound always to reason by analogy from animal experiments to human phenomena or behavior. Now, it will have been observed that the experiments referred to above have used infrahuman animals as subjects. Yet the results obtained with them may be applied to human learning and behavior. In the first place, experimental results found with primates, which are high in the evolutionary scale, correspond with those obtained with lower animals. Further, Lashley has found that although as we go higher in the evolutionary scale there is increased specialization, the relation of brain areas to learning does not differ significantly in man and lower animals. Finally, it has been shown clinically that after the occurrence of a cerebral paralysis in man the defect need not be permanent, and that loss of tactile discrimination and localization, due to cortical damage, may

[25] Franz, S. I., "The Neurology of Learning," chap. 8 in *Comparative Psychology* (F. A. Moss, ed.), New York, Prentice-Hall, 1934.

be recovered by training. Also, it is generally recognized that there is a possibility of re-learning, perhaps through the use of other parts of the brain, even when speech, movement, or some form of perception has apparently been lost through cortical damage or destruction. In the light, then, of the general consistency of results, from lower animals through primates to man, it seems quite reasonable to carry over Franz's and Lashley's finding to the rôle of the brain in human learning.

Summary. We have indicated that the goal and motive in learning are of prime significance, and that incidental and mechanized learning are relatively unimportant as well as being undesirable. We have also shown that insight is essential if the thing learned is to have the greatest value for the person concerned. An individual is best motivated to learn when he has an active attitude of desiring to learn; for he is then not only properly stimulated, but his feelings of pleasantness or unpleasantness provide an important element in the satisfaction felt upon successful learning or in the dissatisfaction or disappointment of failure. With proper motivation the learning activity is his own, and not one imposed from without.

It was shown that learning proceeds from undifferentiated or fused wholes, or units, to finer and finer differentiation, thereby enriching the individual's environment, refining it, and revealing relationships, similarities, and differences. Differentiation is necessary before assimilation, or synthesis, in behavior and learning is possible, and before the full and varied nature of an object or experience can be utilized by means of redefinition.

We indicated, also, that the conditioned response theory provides an adequate description of some of the more stereotyped and mechanical forms of activity, and of the modification of children's emotional responses as well. But it does not offer an adequate account of the more complex forms of learning, some of these being among the most significant

aspects of human behavior, such as problem-solving and creative activity.

The rôles of the factors of repetition, precision, primacy, recency, and organization were presented, not as so-called "laws" of learning, but rather as conditions which, if appropriately employed, can facilitate learning. It was then shown that methods of learning and teaching play an important part in determining whether a particular learning activity shall provide one kind and amount of general transfer effect, or another kind, if any. This problem again emphasized the significance of an active attitude and a goal in learning.

Finally, we indicated that though the nervous system, receptors, and muscles are necessary in learning, very little of a definite character can now be said regarding what takes place within the individual's organism in the learning process. In other words, our knowledge of the psychology of learning far exceeds our knowledge of its neurology and physiology.

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Chapter XI

THINKING

That thinking contributes enormously to the range of human knowledge everyone must be able to recognize. If our knowledge had been limited to sensory perception alone we should know very little indeed, perhaps not much more than a five-year-old child, and actually not even that of a five-year-old child of today, because the effects of the thinking of adults through many years appear today in the objects for which children develop perceptions. Inventions and discoveries of every kind follow or are the consequence of thinking.

Of the effects of thinking upon human life and its institutions there is no question, but of the essential nature of thinking as a phase of human behavior and development psychologists are not so clear. There has been a long struggle to understand thinking as a psychological problem and it still continues to be one of the more uncertain fields of psychological knowledge. Without much question, however, the best approach to an understanding of thinking is by way of the psychology of perception as considered in an earlier chapter. Certainly one should be quite familiar with the psychology of perception in order to understand current trends in the psychology of thinking, because thinking is now quite commonly assumed to be an outgrowth of perceptual response.

Nature of Concepts. In an earlier chapter the example was used of a man perceiving the approach of his neighbor's car from the sound of the horn of that car. This, it will be recalled, was presented as a large and intricate pattern of re-

sponse established through many sensory-perceptual experiences with that car and its owner but aroused now by a simple stimulus, the sound of the horn, which had been an important feature in those earlier sensory-perceptual experiences of the car and the man. Other and comparable examples were the perception of a hill by one who had studied geology and the perception of a flower by one who had had some botanical training. It must now be observed that a man may have an experience much like that of perceiving his neighbor's car but without the actual presence of that car nor of the sound waves from the horn of that car. The geologist, or anybody, may have the experience of the hill without the hill being physically present to the eyes. He may be aware of it, he may "think" of it, without the hill being anywhere around. Likewise the flower may recur in the experience of the botanist or anyone else without the flower actually being present. Such a perception-like experience of an object without the physical presence of the object is commonly designated a *concept*.

But concepts are not limited to those which are directly related to perceptions of physical objects, sometimes termed "concrete concepts." There are also concepts of abstractions or abstract concepts. These also have apparently grown out of perceptual experiences. One may, for example, perceive a flower, observe that it has wilted, see it placed in water, and observe that it freshens-up again. After many such experiences there is an enlarged perceptual response including the awareness of causation, that the water freshens the flower in this instance. Gradually this feature of the response, that one object may have an effect upon another, is isolated or abstracted from the whole of the perceptual response and we say that we perceive a causal relation. Well, it is likewise possible eventually for one to be aware of a causal relation without having any objects present. Thus we have concepts of relations which have no more apparent physical stimulus than any other concept. We also have abstract concepts

which have grown out of many perceptions of objects perceived to be similar. After perceiving a tree it is possible to have a concept of that particular tree. But after perceiving many different kinds of trees and observing their likenesses and differences we come to have the concept of tree in the abstract which is not that of any particular tree nor of any particular kind or class of trees. And there are also concepts of kinds of trees, pine trees, oak trees, beeches, and so on, each of which has grown out of its own group of perceptual response patterns.

The course of the development of concepts has been much studied, although it cannot be said that it has yet been completely worked out. Piaget among others has done much carefully planned questioning of children and observing of their responses to these questions. As a consequence of his studies he concludes that concepts of causality do not ordinarily become fully developed much before the 11th to 12th year. Simple forms of causality notions appear earlier to be sure, some of them remarkably like those of primitive man, but growth into all the different forms of causality concepts is a process requiring several years for its completion.[1]

Nature of Thinking. After one has grasped this notion of a concept, as a response generally perceptual in nature and origin, it is possible to grasp one of the current beliefs concerning the nature of thinking. Thinking is in part the experience of a succession of conceptual experiences; but that is emphatically not all of thinking. Thinking is not ordinarily observable by others because the response activity is too slight to be apparent (although delicate apparatus may record it). It may be merely activity in certain patterns within the brain itself; it may involve very slight bits of activity in the muscles of speech; and it may mean rather large

[1] For the work of Jean Piaget see his books, *The Child's Conception of Physical Causality*, *The Child's Conception of the World*, and *Judgment and Reasoning in the Child*. (All are Harcourt, Brace publications.) In this connection the reader should see also *The Growth of the Mind*, by Kurt Koffka (Harcourt, Brace, 1924).

patterns of exceedingly slight activity in the larger muscles of the body and limbs.

Thinking is achieved when these response patterns developed by sensory-perceptual experience stimulate each other. Thus when we "think" of this and that and the other thing, there is a succession of conceptual activities within the human organism each of which arouses the next. This arousal of one concept by the preceding we frequently describe as associative arousal. But thinking also involves alterations of the concept patterns. As we think from one thing to another, portions of individual concepts disappear, portions of concepts fuse into new conceptual patterns. There is an almost continuous modification. One new pattern stirs an attitude of acceptance; another new pattern or combination arouses rejection. So by this stream of changing conceptual experience problems are solved, new plans developed, stories created, pictures and statues conceived, dreams built.

Physiological Aspects of Thinking. Just how the body functions in thinking is the phase of this topic which has been the source of much of the controversy. The most obvious feature is that thinking involves brain activity. This can be readily demonstrated by the cessation of thinking whenever anything damages the functioning of the brain as a whole. And there are also evidences from pathological studies, where deteriorations of brain tissue in limited areas are demonstrably related to distortions or marked limitations of thinking. But of the particular way in which the brain is involved in thinking there are at least two general points of view which need to be considered.

Some there are who believe that thinking is peculiarly confined to cerebral brain activity. Some people like to use the word "cerebration" for this. They contend that when we think we are using the brain; and, that there is a stream of activity flowing about from one area and pattern within the brain to other areas and patterns likewise within the brain.

According to this belief for every concept there would be a special cerebral pattern. When that neurone pattern in the cerebrum is activated we should have the corresponding experience of a concept. As thinking flows from concept to concept so it is supposed that one of these neurone patterns stimulates another and that another.

Others believe that the physical accompaniment of a concept is quite as much a matter of the body as a whole as is the corresponding and psychogenetically older perceptual response. It will be recalled from the preceding chapter that a perceptual response involves many incipient tendencies to action, movements which are so slight as to be unobservable by ordinary means. These are often termed implicit responses. If, it is argued, a concept is but the rearousal of much of the perceptual pattern by some means other than the usual stimulating presence of objects, then the *concept* experience must likewise involve these muscle and organic activities. Perhaps this is so. Some experimental work appears to support this belief. It has been found that there are slight muscular activities accompanying thinking which can be demonstrated by recording the accompanying electrical activity. According to this belief concerning the physiological aspects of thinking, it follows that as thought flows on from concept to concept there is far more involved than the simple arousal of one brain pattern after another. The arousal of a brain pattern must produce the appropriate activity within muscles of the body and this in turn serves as the stimulus to the next conceptual response pattern.

According to this latter view, if one's thinking wanders from the concept of a tree to the concept of a farmer and from that to the concepts of a cow and an automobile and a house in this order, instead of each of these in turn being aroused by an objective item as in the case of a perception there would be something in the response pattern we call the concept of a tree which stimulates the response pattern

we call a farmer and then each conceptual response pattern would in turn have in it something which stimulates the next response pattern.

Another similarity between thinking and perceiving should also be observed. This is the fact of a progressive change in concepts just as continued experience results in changes in perceptual responses. The concept of a tree may grow out of perceptions of trees, but it does not remain limited to such perceptions. One may observe alterations of concepts by the progressive subtraction and addition of features. In other words the meaning of a concept changes. In childhood days we may, for example, have acquired a concept of the principle of evolution which meant primarily and largely that human beings as they are today had descended from monkeys or monkey-like ancestors. Biological and anthropological reading and study in later years brings much alteration to this concept of evolution until it becomes vastly richer and more inclusive than that original childish notion. In meditation we experience first one concept and then another. The result of this recurrent observation of now one concept and now another may and often does result in the alteration of one or both of these concepts. Similarities and identities are brought to attention. Benjamin Franklin having the experience now of the concept of electricity and now of lightning became aware of so much identity that for him the concepts largely fused into one and he thus asserted his belief that electricity and lightning were the same. This, as a good thinker should, he proceeded to prove by his famous kite experiment. Professor Woodworth uses the clever example of two college boy friends talking about their fathers.[2] Talking about them aroused the concepts of each. As they talked about them, expanding the concepts of each by interchange of information, it became suddenly evident to each that the fathers were in the same college at the same time. Immediately there came the

[2] Woodworth, R. S., *Psychology* (3rd ed.), p. 465.

awareness that they very probably knew each other. Thus are concepts altered and expanded by a process extraordinarily like that by which perceptions are built up and altered.

Forms of Thinking. This modification of concepts by experience and observation frequently receives different designations according to the amount of control or direction involved. If the process is heavily dominated by the desire to solve some present problem, then we commonly designate that form of thinking as *reasoning*. Sometimes, however, there is a flow of concepts with a progressive modification of them which is far less dominated by a present problem. This is termed *productive imagination*. The planning of a story or the imaginative flow by which the concept of a picture or a statue is developed are good examples of this form of thinking. There is the influence of a purpose to be sure but the control is far less exacting or close than is present in what is termed reasoning. Frequently, too, we find ourserves merely considering now this concept and now that. There may be some slight control by a desire to solve some problem or achieve some end but it is often not very apparent. One feels that he is merely considering without definite purpose, much as he might look over one piece of pottery and then another or casually pause in a store and examine indifferently now this object and now that. When we are so indifferently examining now this concept and now that we describe the experience as *meditation*. It is a very useful form of thinking because from such largely purposeless meditation has come the observation of many important relations, the development of changes in concepts which we now think of as brilliant discoveries. One chemist of distinctive achievement has insisted that he gets his best ideas when seated gazing out of the window and merely meditating.

Then there are times when our flow of thinking appears to be but little if at all controlled by anything in the present

situation. This we term *day-dreaming* or *phantasy thinking*. There was a time when this form of thinking was termed free because it was so free from control by present problems; but we are not inclined to think of it as free now because we realize that it is actually governed by desires which have been blocked or which remain unrealized. The boy whose medical ambitions are blocked by the necessity for several years of further study day-dreams of being a great surgeon; the girl who longs to become a great actress likewise day-dreams of seeing her name in the lights over a theater entrance. Such thinking is free from control by the present situation to be sure, but very far from being entirely free of control. The control is by these unrealized desires. Hence it is termed day-dreaming or phantasy thinking. Probably the nearest approach to free thinking, in the sense of freedom from directive control, is that which we know as *dreaming* (while one is asleep). Some dreams appear to be quite free from control either by the present situation or by unrealized desires. These appear to be the free associative activity of a sleeping brain when disturbed by some intruding stimulus. Other dreams, however, do appear to be controlled by unrealized desires. Thus one may consider thinking as having many different forms which range all the way from reasoning at one extreme to the uncontrolled stimulus-aroused sleep dream at the other. The differences being in terms of the amount of direction or control in the sequence of concepts aroused. It is these different forms of thinking which must now be considered in greater detail.[3]

Reasoning. This form of thinking is aroused by the perception of being in a situation for which established responses are not adequate. The realization that one is lost in the woods, the discovery that one is without money in a strange town, the need for a bit of carpenter work without

[3] The term *reproductive imagination* is sometimes used for the designation of all forms of thinking which are weak in direction control, probably because there is in this form of thinking so little modification of concepts and the infrequent appearance of new concepts.

having the proper or usual tools—all these are good examples of the perception of a situation in which or for which the established habits are not adequate. Awareness of the problem is more important than one might at first think. Frequently scientific research has been delayed because of the inability of scientists to formulate exactly what it is that we do not know. When a problem can be clearly stated a first long step has been taken in the direction of achieving its solution.

This awareness of the problem may be itself an indication of ability or of maturity. Professor Heidbreder found in the study of children that very young children, three years and under, when confronted by an experimental situation did not apparently perceive it as a problem for solution. Four-year-old children usually perceived it as such, and above that age apparently all of her subjects did.[4]

When one is faced with a situation which calls for some new response that will be effective, then one normally has a number of different possibilities "come to mind" as it is termed. Probably it would be wiser to describe this as the tendency to do any one of several different things, or to describe these as conflicting tendencies to action each of which might serve as a solution of the problem. Take the example mentioned above of the necessity of doing some carpentry work without the proper tools. Perhaps what is needed is a hammer. One thinks of a hair-brush perhaps, of a stone, of a wrench, perhaps of a slipper, and finds that none of them are adequate. Then the possibility comes of tying a flat stone to the end of a stick and one finds that by such means the problem is readily solved. A little recall of the details of anyone's personal experiences with the solution of problems will soon reveal these same phases of the reasoning process—the recognition of the problem, the various possible

[4] Heidbreder, Edna, "Problem Solving in Children and Adults," *Journal of Genetic Psychology*, 1928, 35, 522-545.

solutions, and then the eventual trying or testing out of what appear to be the best as a means of proving that some one of the possible solutions will work. Frequently it will be found that solutions which look promising are tried out in imagination and accepted or rejected before being tested objectively. It is also important to observe that when one is seeking the solution to a problem, irrelevant ideas are suppressed or neglected and only what appear to be relevant notions permitted to come to attention. There is thus observable the influence of some directing influence.

This directing influence in the selection of possible solutions is what makes reasoning distinctly different from other forms of thinking. A variety of names (direction, determining tendency, *Aufgabe*, intention attitude) have been given to this but all of them indicate the recognition of its selective controlling influence.[8]

Careful examination of different instances of reasoning reveal also certain less conspicuous differences. Sometimes, for example, the person feels utterly helpless, is unable to conceive of any solution which appears to be at all practicable, and then, after much hesitation (note conflict of inadequate responses), what appears to be a complete solution flashes into being as if from some supernatural source. It jumps out as complete and as clear in detail as the suddenness of the discovery of the hidden item in a puzzle picture. Examples of this are found in the solution of mathematical problems. There is no necessity, however, for assuming here the influence of some supernatural influence, or of some magical power in a subconscious personality, as some have done. The details for the solution were present all the

[8] English, H. B., "An Experimental Study of Certain Initial Phases of the Process of Abstraction," *American Journal of Psychology*, 1922, 33, 305-350.

Maier, N. R. F., "Reasoning in Humans," *Journal of Comparative Psychology*, 1931, 12, 181-194.

Titchener, E. B., *Psychology of the Thought Processes*, New York, Macmillan, 1909.

time in the knowledge (old response patterns) of the individual but their isolation and recombination had not been achieved prior to the moment of apparent illumination. At the moment when they did come together in the effective manner there was the instant recognition of the fact and its acceptance.

Mental test studies have dramatically shown how we grow from little or no ability to reason in early childhood up to some considerable degree of facility in the solution of problems in maturity. And they have also shown that adults differ greatly in the facility with which they isolate and recombine details for the production of solutions to problems and for the perception of the relationships necessary to such discovery of solutions. Here lies the great difference between the intellectual genius and the average man, between a Newton or an Einstein, for example, and the rest of us. Such persons see significances and relationships which most of us pass by as of no importance. And the rest of us look with amazement upon the behavior of morons who when confronted with problems which we can solve quickly appear quite unable to conceive of the solutions which come to us so readily. Some children when confronted by the familiar ball-and-field test problem [8] ramble around in an aimless and ineffective manner indicating that there is no clear awareness of the significant aspects of the problem and ways for its solution. Piaget has reported that small children do not reason because they are too self-centered. Perhaps this could be better expressed by saying that in such children the course of the appearance of possible responses is not governed by the directing influence which comes from purpose and desire growing out of a clear perception of the problem. Their habits so largely concern themselves that

[8] This is a well-known item in the Stanford-Binet test for intelligence. The child is presented with a drawing of a circular field and told that a ball is lost in the field. The child's task is then to show how he would proceed to find the lost ball.

the habits of independent problem solution have not yet come into being.[7]

Reasoning by Scientific Methods. When the man mentioned above discovered that he could solve his simple problem by tying a stone to a stick and thus make a very primitive sort of hammer, but one which nevertheless helped him out of an awkward situation, he did not discover anything of great importance to mankind. The primitive man who first did that very thing, however, did make a discovery of vast importance. Later on it was found that stone was not the most satisfactory form of hammer head. Then a new problem arose and new solutions were necessary. Eventually the modern type of hammer came into existence with the many variant forms for special purposes. With hammers geologists have been able to break rocks and to add enormously to our knowledge of the earth and thus to solve problems concerning its history and the history of life upon this earth. The first man to solve the problem of moving a heavy object by working under it some round object upon which it could be rolled started a train of problem solutions which has culminated in the great variety of means of locomotion, self-propelled and otherwise, which we enjoy today and take so for granted that we often fail to think of the long history of problem solving behind them.

Those primitive discoveries may have come by some chance perception of relationships or by some accident of nature which forced them upon human perception. But progress of human knowledge by problem solving has now gone so far that accidents of nature and chance observations are seldom the means by which genuinely new knowledge is achieved. It is achieved today by planned effort. Problems are outlined; possible solutions are conceived; and then highly elaborate programs of work are often necessary to

[7] In addition to the Piaget books already mentioned above the thoughtful student is referred to Hazlitt, V., "Children's Thinking," *British Journal of Psychology*, 1930, 20, 354-361.

demonstrate which of the possible solutions is the correct one. Sometimes, too, vast programs of work are necessary in order to stir in the minds of experimenters conceptions of possible solutions. This has to be tried and then that in order that the experimenter may be able to see his problem in its different possible settings before he can hope to set up procedures for its final solution. Through all modern scientific research one may trace these same aspects of the reasoning process.

Example of Scientific Procedure in Psychology. An example of scientific research for the solution of a problem in the field of psychology may be illuminating at this point, although examples could quite as well be taken from any other science. In this instance the question arose if the smoking of tobacco had any effects upon human behavior, any effect which might be termed psychological. That was the problem: if the smoking of tobacco has any effect upon human behavior, what is it? Various possible effects had been and were conjectured, possible solutions to the problem, such as the reduction of ability to learn, the reduction of ability to think, the great improvement of ability to do creative thinking, inaccuracy of eye-hand co-ordination (important in athletics) and so on. But a scientific man constantly seeks reliability. He must be able to answer with full confidence of reliability when laymen ask him questions, for if his answers are not reliable he is certain sooner or later to find himself in very embarrassing situations. Consequently much of scientific endeavor is designed to make conclusions as reliable as possible. The psychologist wanted to be able to answer this question about the behavior effects of smoking with a high degree of reliability.

Some work had already been done toward the solution of the problem and some alleged effects had been determined. But this work had been done by methods which served primarily to arouse other problems for solution. Men were asked to smoke and before doing so were tested for various

functions. After smoking a prescribed amount they were again tested for the same functions. These tests revealed a loss of accuracy in eye-hand co-ordinations. Some people thought that this offered one answer to the problem. There had been a definition of the problem, a lot of possible solutions proposed, some of these had been put to experimental test and one of them apparently found reliable. But then another question was perceived. Was this loss of eye-hand control actually the effect of the tobacco or was it the effect of suggestion? The subjects knew that they had smoked and they also knew, or might have known, the common belief that smoking affects eye-hand co-ordination. So one investigation had served to raise another question for solution. What was needed was that which is commonly designated as a "control." This means a checking by use of another group of subjects upon whom all stimulating effects would be as nearly as possible the same except for the one significant fact that they were not subjected to the possible effect of tobacco. This had been tried by having another group of subjects take the same tests but instead of smoking they merely sat around and killed time until a comparable interval had elapsed. But obviously these subjects knew that they had not smoked and so were possibly subject to suggestive effects in their test achievements. So the problem remained unsolved. Various possible solutions were proposed. One could think of a number of answers and be inclined perhaps to support some one of them actively by argumentation; but argument is not considered an adequate solution of a problem if it can be subjected to scientific experimentation. A subsidiary problem was then confronted of devising some means whereby two groups of subjects could be tested under as nearly as possible the same conditions even including the matter of tobacco. That would mean that both groups of subjects must be led to believe that they had smoked, although one group had actually not done so. Then and only then would all conditions be comparable. If the subjects

who smoked should show a significant difference in their test results, the conclusion would then inevitably follow that the difference was due to the tobacco. This was a difficult problem but through the genius of Professor Clark L. Hull, at that time of the University of Wisconsin, it was solved. He devised an apparatus which made all subjects believe that they were smoking during this part of the experimental procedure when the control group of subjects actually were not being subjected to the tobacco effects.[9] This work did reveal that there was the reduction of accuracy in eye-hand co-ordination indicated by the earlier work, but of course now the question of cause had been solved. It was made clear that the effect on eye-hand co-ordination must be attributed to the tobacco and not to suggestion. This presents a good example of how knowledge grows by reasoning with experimental support for the achievement of reliability.

Expansion of Knowledge by Reasoning Alone. Sometimes experimentation is impossible and then resort must be made to logical procedures alone. Frequently knowledge is sought concerning that which is beyond the possibility of direct experimentation. Then the reliability of conclusions must depend upon the soundness of the reasoning. Geologists for example cannot actually discover by direct experimental observation what the climatic conditions were in some early period of the earth's history. Expansion of knowledge must for them come by reasoning soundly from what may be observable and what has been established by experimentation.

When the geologist examines samples of petrified wood which grew long before the dawn of history and finds growth forms which botanists today know are produced only in a swampy area with a very damp climate, the geologist can properly conclude that it was a swampy area and a very damp climate which produced this wood. He thus learns

[9] Hull, C. L., "The Influence of Tobacco Smoking on Mental Efficiency," *Psychological Monographs*, 1924, 33, no. 3, 1-160.

the nature of the climate and something of the landscape in a period which is no longer subject to direct observation. Here the reliability of his conclusions is generally accepted as very high. If, however, it should be discovered that such growth structures could be produced by any other type of soil and of weather, or if it could be proved that the growth forms in the petrified specimen were not exactly like those studied by botanists today, there would be some unreliability in the conclusion. A new problem would then arise, that of discovering what the conditions actually are which will produce the same form of structure as that found in the petrified sample. Again resort to experimentation would be necessary.

Kinds of Psychological Methods. In psychological investigations two general groups of methods are to be observed. Sometimes it is necessary to depend upon the subject's own description of how he feels or thinks, what his attitude is, and so on. This is known as the *introspective method* and the results are known as *subjective data*. There have been periods in the history of psychology when great stress has been placed upon this procedure. And there are psychologists who contend that only by such direct observation of personal experience can an adequate science of psychology be established. A simple example of this method would be to prick a subject with a pin and then have the subject describe his perceptions, feelings, emotions and so on in response to the pin-prick.

The other method or group of methods is known as *objective* and the data obtained as *objective data*. Here there is strictly no self-observation. The attempt is to record as automatically as possible the subject's response to the experimental situation. The research mentioned above on the effects of smoking is a good example of this method. An objective utilization of the pin-prick experiment mentioned in the above paragraph would be to have attached to the subject a variety of recording devices which would mechani-

cally make record of changes in muscle tension, of changes in respiration and heart beat, perhaps also of blood pressure, photographic apparatus to record all bodily movements, and some recording device to make permanent whatever vocal response was included. Then the pattern of responses to the pin-prick could be delineated. Objective methods have been developed because of the difficulty of obtaining reliable introspective or subjective data. Adequate descriptions of one's own experience are very difficult to make, and they are often biased unintentionally. But it is also contended that the objective methods when used exclusively fail to obtain some very important features of the response to the given subject.

In addition to the above sometimes termed experimental methods there must be recognized also what is known as the clinical or *genetic method*. Case histories are often the only means of discovering why an individual behaves or responds as he does. Reasons for children stealing may be found by studying the case histories of a large number of children who steal and then comparing the general features of these histories with the general features in the case histories of a comparable group of children who do not steal. In the introduction of the control group for comparison there will be seen as near an approximation as possible to the experimental procedure. The experimental method is considered the ideal to be approximated as nearly as possible because it produces the highest degree of reliability. The same reasoning procedure will be found in principle in the genetic method as in the experimental method: there is the statement of the problem, the suggestion of possible solutions, and the development of a plan for case history studies which will reveal what is the best solution to the problem.

Why the Use of Apparatus and of Statistical Methods. These are to be thought of as aids to reasoning. They contribute much to the reliability of conclusions. One may for example observe what appears to be large individual differ-

ences in speed of response by watching different persons deal cards, but a conclusion based on such casual observation may not be very reliable. Certainly one could not safely say from such observation that any one person is always slow in response. Perhaps on the evening observed that person was very tired. But when apparatus is used which automatically records speed of response, and the procedure is repeated many times, then much more reliable conclusions can be arrived at. Likewise one may think that a certain person or a certain animal is very quick and clever in solving problems or unusual situations: but greater reliability is achieved when specially designed apparatus is used. Then each person tested is subjected to approximately the same conditions and the conclusions are based upon automatically made records and cannot be subject to the bias of a prejudiced observer. Sometimes, too, there are features of the response of a subject in an experiment which cannot be directly observed at all. There may actually be slight but important shifts in the general pattern of muscle tensions, although the apparent attitude of the subject does not change. Such slight shifts of muscle tension can often be readily recorded by proper apparatus and thus add much to our knowledge of the individual subject's response.

Statistical methods supplement the use of apparatus. One might, for example, give a human being the task of finding his way through a certain kind of maze, and because he did it quickly conclude that he learns rapidly. But that would not be a very reliable observation. It is necessary to have the subject go through the maze many times. When that is done it will probably be observed that sometimes he does so quickly and sometimes rather slowly and at other times his speed varies between the extremes. Little things which cannot be controlled and made constantly uniform cause these variations. Fatigue, interest, distractions and so on all contribute to the degree of speed manifested. The effect of these may be largely canceled out by many repetitions.

Then if the time is taken for each an average will presumably show more nearly what the time would be if all of these little disturbing effects could be held constant or eliminated.

One also is likely to want to know how any given subject ranks in comparison with other subjects. This question frequently comes up in connection with all kinds of test procedures. A mean then is inadequate for any very exact statement about the individual's comparative standing in a group. Measures of variation above and below the mean are desired. For these and other features of measurement useful devices have been developed and are commonly used by psychologists to increase the reliability of their work.[1]

Common Forms of Bad Reasoning. The course of normal reasoning as outlined above in which a problem is perceived, solutions conceived and then the correct conclusion selected by test either experimental or logical, is a procedure so rigorous and exacting that it is commonly not followed. Many people are unable to do so and others believe it is unnecessary. The result is much bad reasoning. Sometimes people jump at conclusions. They may be aware of a problem; some possible solutions come to mind and one of them is grabbed hastily and accepted as satisfactory for reasons that are not always discoverable. The process of testing or proof is omitted. We see plenty of examples of this in the kind of thinking commonly called *intuition*. The chief defect of this is that the conclusion cannot be justified. It may to be sure sometimes turn out to be correct and then the person's belief in himself, in his own "hunches," is reinforced but he cannot give logical justification for the conclusion at which he arrived. Often it turns out to be wrong and then the person is prone to forget all about the whole matter.

Generalization from too few cases is a common example of bad reasoning. People believe in ghosts or telepathy or

[1] For further knowledge of statistical methods the student should consult any one of the many available texts.

something because of some one or some few experiences. The unlucky nature of the number thirteen may be accepted for truth because some one person was injured in some association with that number. A person is judged to be dishonest because of one questionable action, although the person who makes the judgment would not care to have his own character estimated from the one instance when he slipped. And, in connection with this defective reasoning by conclusion from one or two few cases, there should be mentioned also a common tendency to reach conclusions from the observation of instances which agree with some desire or preconceived notion.

This is commonly termed generalization from positive cases only, neglecting the negative cases. Many persons believe that "dreams come true" and present in evidence a few cases in which there are subsequent events which do appear to have some features in common with the content of a dream. But such persons make the mistake of neglecting all of the many dreams which were not followed by corresponding events. Sometimes people assert that dogs have a degree of intelligence approximating that of human beings, as they put it "dogs can think." A little inquiry reveals that these persons own dogs for which they have much affection; and, having observed one, or perhaps a very few, instances of very clever behavior on the part of the dog, they jump to this extreme conclusion concerning the intelligence of dogs in general. They forget the possibility of a mistaken interpretation of the particular action and also that they are generalizing about all dogs from the behavior of one or two. It is quite possible of course that such a person happens to own a dog which, among dogs, is of very superior ability. He is thus not justified in such sweeping generalizations.

A very common form of bad reasoning when people begin to psychologize is the assumption of some very elaborate interpretation when some much more simple interpretation would serve to explain all of the observed facts. When, for

instance, two persons walking the street together happen to give expression at the same time to the same thought, it is not good reasoning to assume the presence of telepathic influence between the brains of the two persons. The similarity of thought can be explained in terms of similarity of training, interests, and appropriateness of the momentary situation for that thought. The principle here is sometimes known as the law of parsimony and sometimes as the principle of economy or Lloyd Morgan's canon. Briefly stated it is that when two possible explanations appear, each of which apparently explains all of the known facts, it is better to accept that which is the simpler. The wisdom of this principle of thinking has been demonstrated through many years of scientific research and prevails quite as much in other sciences as in psychology. There may be more occasion for emphasis upon its importance in psychology than in some other sciences, because in the study of human and animal behavior it seems extraordinarily easy to be satisfied with elaborate explanations in terms of the occult and the supernatural.

Imagination. This was mentioned in the earlier part of this discussion as a common form of thinking and described as a flow of concepts undergoing modification but only partially dominated by a present problem. At least five forms of it are to be observed: reproductive, productive, meditative, day-dreaming and dreaming while asleep. It was distinguished from reasoning by its partial freedom from the necessity of solving a particular problem. If reproductive imagination is thought of as the simple re-arousal in imaginative form of something like former sensory-perceptual experiences, and if productive imagination be thought of as the breaking-up and re-combination of these re-aroused experiences, then it will be quickly observed that both forms of imagination are to be found in what has just been described as reasoning. In the conception of a problem and in the development of possible solutions, imagination takes

place, both productive and reproductive. Meditation also appears at times to be a feature of reasoning, as one sits and considers, reproductively contemplating one aspect and another of the problem.

What actually is taking place in any form of imagination has been a problem at times of much concern to psychologists, but one which in recent years has not received so much attention. When the introspective method of studying human behavior was popular, there was much consideration of imagination because it was believed to be a problem of high importance. Anyone may today examine his own mental processes when he is imagining things and observe many of the features which the earlier psychologists worked with and talked about. One can imagine things in "his mind's eye" as it is said; and, when that experience is placed under examination, it will be found to be the reproduction, without apparent visual stimulus, of what has formerly been experienced through the use of the eyes. But it will also be observed that all thinking is not done with imagination of this visual nature. Sometimes it might be more appropriate to speak of the "mind's ear" because it is possible to hear sounds for which there is no apparent auditory stimulus, or at least to have experiences of some sort which appear to be very much like those we have when the ear is stimulated. We can think of the sound of a bird, of the voice of a friend, of the timbre of a particular instrument and so on. And we can also, in a comparable manner, imagine smells, tastes, touches, warms, colds, pains and many combinations of them.

These different forms of sensory-like reproduction in imagination are termed *images*. Some psychologists have thought that they were directly comparable to sensations, although without peripheral sensory stimulation. They assumed that such images were due to the central arousal of the same cortical area which is active when the corresponding sensation is experienced, or of some closely associated

area. Other psychologists have contended that every image is essentially a sensory experience, that it is actually aroused by a peripheral stimulus. The position here taken, it will be observed, is somewhat between these two extremes. The image is here thought of as a part of a response pattern which was originally set up by perceptual experience. Now that pattern may be aroused by some other pattern of response, whether purely cerebral or involving muscular activity as well remains to be proved, and the image which we talk about is one portion of the pattern isolated for description and consideration.

It has been observed that individuals differ notably in the facility with which they can arouse different kinds of imagery, and as a consequence some psychologists have thought that this might be a basis for a proper classification of human being into types. Those who could and did use visual imagery predominantly and freely were termed "visiles"; those who could and did use auditory predominantly were termed "audiles"; and so on, although there seemed not to be much emphasis upon other types. Further study, however, revealed that these types were misconceived, were the product of incomplete observation. A single person may report much use of visual imagery, for example, and as a consequence be classified as a visile but he may at other times and for other kinds of reproduction use other than visual imagery. And it is highly probable that he may speak in the language of vision and not have any such imagery corresponding to it at all. Our thinking is much more complicated and variable, especially variable, than this classification in terms of types would imply. The notion that images are the direct re-arousal of former sensory experience is also now seriously questioned. In the experience we call having an image there may actually be a stimulation of the sensory end-organ and of the sensory tract and of enough of the associated responses to produce an experience enough like the earlier perceptions to be accepted as closely comparable.

If this is true, then what we call images are really a form of sensory activity or sensory response.

It was also contended that we have in addition to the above forms of imagery, which were often termed concrete, still another set of imaginal forms growing out of our experience with language. There were supposed to be visual verbal images, auditory verbal images and combinations of these such as auditory-motor verbal images. Anyone can readily discover that he does much of his thinking in the form of words, even though these words may often be highly schematized. But it would be dangerous indeed to assume that this is a purely cortical reproduction of former speech experience, that the verbal image is without sensory feature. Actually what seems to be happening is that speech comes first and that from these vocal responses there is gradually developed the ability to have the same patterns function in a reduced manner. This is often designated as sub-vocal speech. We often find ourselves talking inaudibly and if we put our fingers on our throats can feel corresponding movements there. The so-called verbal imagery then may be but an extreme form of sub-vocal speech. Experimental work seems to be slowly demonstrating the truth of this later contention.

How changes take place in this field with growth has been studied somewhat. Many years ago Francis Galton made an oft-quoted study[19] which seemed to indicate that children think freely with what was termed above concrete imagery and that as we grow older there is the progressive substitution of verbal imagery for the concrete form. This is but saying in another and perhaps less accurate way that as language develops we are able to think of abstractions which could not be readily conceived before, and that the life of the adult is concerned more and more with abstractions which are in essence verbalized forms of response. Hence,

[19] Galton, Francis. *Inquiries into Human Faculty and Its Development* (Section entitled Mental Imagery).

when the adult examines his so-called conscious experiences, he finds in them much of a verbal nature, much which is to a greater or less degree sub-vocal speech. Obviously education would contribute much to this and it would also appear that persons of any age would differ in the extent of this development of sub-vocal or verbalized response according to the amount of education they had experienced.

Eidetic Imagery. Another growth change in the nature of imagery concerns the appearance and disappearance of what is known as eidetic imagery. This form is reported to appear in later childhood and ordinarily not to last many years. By maturity most persons have lost this form entirely, if they ever had it at all. While there now seem to be a number of forms of eidetic imagery details of which cannot wisely be considered here, the chief features appear to lie in a greater likeness to the behavior of sensory responses. The eidetic image is experienced as projected, outside of oneself, just as are the corresponding sensations. Children are reported as being able to recall a picture in a manner which is so like that of the original sensory experience of the picture as to make it possible for the child to report details of the picture not noticed in the original examination. While reporting such imagery the eidetic person behaves much as would other persons in attentive response to some external stimulation. In some cases the eidetic images appear to be an annoying intrusion; in other instances the eidetic person apparently does not know of their existence, or their possibility, until experimentation calls attention to it.

Just what these eidetic imagery contribute to the growth of the individual or to the expansion of knowledge, if any, is not yet certain. They may be highly significant and they may not. Much experimentation with them is in progress and so the reader should be aware of the possibility of their becoming of considerable importance to the understanding of presentations of growth changes.[11]

[11] Jaensch, E. R., *Eidetic Imagery*, New York, Harcourt, Brace, 1930.

Productive Imagination. What has been termed *productive imagination* obviously functions in reasoning as one seeks to conceive possible solutions and how they may work out. It is also to be observed that such imagination functions largely in the play life of both children and adults. In the play of children one may often hear a child say, "Now you be the papa and I'll be the mamma." Then they proceed to carry on in these parts living for the time being in a world of their own imaginative construction. Adults frequently aid in this imaginative life of children by telling them stories of giants and fairies and talking animals and so on, all of which depend upon the ability of the child to imagine things and actions which do not exist in their world of perception. The games of adults leave somewhat less perhaps to productive imagination, nevertheless one may see it in card games, chess, and checkers. In these games it is necessary to imagine the possible outcome of one play or another.

In the more serious business of childhood and adult life the productive or creative function of imagination can be frequently observed. The child may be planning a special kind of costume for some special occasion. Then one will hear proposals of using this and that article in some unusual way in order to bring about the effect of appearing as a gypsy or cowboy or something quite other than the usual. The designing of clothing for adults and children frequently exemplifies this creative use of imagination. The alteration of clothing may produce still better examples. Individual differences here frequently become apparent. One person will reveal special facility in thinking of ways to alter a hat or make over a dress. Some individuals become especially distinguished for their skill in dress design which must involve such creative functioning of imagination. They are thus enabled to see combinations in new patterns of line and color. Mechanics and engineers in planning machinery and great structures of many kinds must be able to think of them in their imagination prior to even the drawing of them.

Artists plan statues and paintings prior to their actual production.

In that phase of reasoning described above as the testing of a possible solution of a problem this constructive phase or function of imagination also appeared. In the solution of some simple problem arising in the care of a house, one may often think of a possible solution. Then it is necessary to think the problem through imaginatively to discover if perhaps the scheme for solution will work. Here again individual differences will appear. Some persons will manifest notable ability to think through in advance of an actual test to discover the possible effectiveness of the proposed solution. Others may be facile in the development of possible solutions but not be so skillful in the imagination of how they will work out. Perhaps this is a difference which characterizes the successful business man from the unsuccessful. The one is able to think through in advance to the probable outcome of his plans; the other may not be able to do so, at least not with the full consideration of all possibilities.

The vocational ambitions of childhood and youth also exemplify this productive imagination. Children imagine themselves as doing and being that which none of their family ever were or did. The child of a New England home may imagine himself a cowboy on a Texas range and believe that this is his ambition in life. The little girl in the slums of a city may imagine herself as a great lady wearing beautiful costumes. In youth, the young man more seriously thinks of himself in now this and now that vocation. He imagines himself by spells as a successful actor, as a physician, as a lawyer, as a bond salesman, and so on. In this there is no doubt much that is definitely reproductive, based on the life of someone whom he knows or about whom he has read; but there is usually much that is constructive, because he is prone to think of how he would be different, perhaps better than those with whom he has been acquainted.

Meditation. As a form of thinking this has received comparatively little psychological consideration. And yet it must be obvious that it is imaginative and that it is also a very common form of thinking. It is more concerned with some particular topic than is day-dreaming, and it is much less characterized by a definite effort at problem solution. In meditation one just continues to contemplate some idea or plan or problem: one turns it over and over observing in a rather impersonal fashion the various aspects of it. No special possibility of solution may be reached. Perhaps the topic of meditation is not one which calls for a solution. And yet this meditative consideration is often a state of mind out of which come very useful ideas. Some years ago an inquiry among scientists revealed that many found their best ideas coming to them in such a meditative state.

Some religious folk have made much of meditation upon religious topics. In some religious exercises the essential feature is the contemplation of items in the life of Christ. That much practice is necessary in order to achieve such habits of meditation as these is not surprising. Probably few people, unless they are brought up where such practices are common, could sit down and voluntarily meditate upon these religious topics.

Day-dreaming. As everyone who has ever day-dreamed knows very well, this is clearly a form of imagination. It is ordinarily pleasant, often because there is in it escape or relief from some trying or uninteresting situation. The boy in school who is bored by the, to him, weary humdrum of the classroom, finds escape and relief in day-dreaming of hunting through the woods and fishing in the streams that flow through the hills. The teacher may be annoyed, and in turn she may annoy the day-dreaming boy back into attention to the present situation, but for a time at least he had found relief and a form of escape from the school room which he found so dreary. At other times the teacher herself may find her thoughts wandering from the dreary task

of reading the children's papers to the far more delightful prospect of the experiences and happy associations of her recent vacation in far places. She, too, finds relief and escape from an uninteresting present.

Such examples as these, and every reader must surely be able to think of many more, reveal the essentially imaginative nature of day-dreaming. But at the same time these examples reveal something of the motivation, as well as the differences between day-dreaming as a form of thinking and reasoning, also a form of thinking. In day-dreaming there is much less control of the course of thought by the features of the present situation. The boy is no longer governed by the demands of the classroom, and the teacher whose mind wanders is temporarily uncontrolled by the necessities of paper reading. It is an imagination almost, if not quite, without control by the present situation. And yet it cannot be safely said that day-dreaming is completely free in the course of its associative flow. There is motivation, although not from the present situation. The motivation is found in the desire to escape and in longings, urges or drives not satisfied by the present situation. The youth who longs to be a great surgeon is prevented from becoming such at once by his ignorance of the facts and the skills necessary to that type of work. Years must be devoted to his studies before he can realize in actuality the success he longs for. Realization is thus blocked. But, although blocked in the world of reality, there is nothing to prevent achievement of the desired in the world of imagination (of fantasy).

So it has been determined that the motivation of thinking in the form known as day-dreaming is to be found not only in a desire to escape but also in the longings and hopes and desires which cannot be realized in the present actualities of life. It is commonly asserted that young people are especially given to day-dreaming. This is doubtless so because they have reached an age in which the requirements of the future, of becoming adult, are most clearly perceived; and, at

the same time, immediate achievement is blocked by a world of demands and requirements which cannot yet be fulfilled.

What people day-dream about seems definitely to vary with age and social status. Children are known to day-dream mostly about plays, games, things to eat, wealth and the activities of out-door life. Adolescents present a much greater variety of topics in their day-dreams. They dream of achievement in a vast number of forms, of adventure and of romance. Adults probably day-dream much less, perhaps because of their greater preoccupation with the affairs of the immediate present. Elderly people doubtless also day-dream and probably much more about the days of their youth and early maturity, when they were not so hampered by the infirmities that block their present desires for activity.

The widespread belief that day-dreaming is always bad for the person who day-dreams is not supported by thoughtful consideration. If a person should be content with day-dreams to the point that he would no longer try any other mode of achievement, then for that person it would certainly be bad. But such persons are of quite rare occurrence. For the purposes of the school room and school achievement day-dreaming is obviously bad; but in the long run day-dreaming may prove to be a worth-while release and may even contribute to the development of the personality.[12] By day-dreaming one may escape the tensions of the present and relax into simple effortless realms of thought. By day-dreaming one may imagine himself in a vast number of different occupations and positions and relationships in life to the end that one's idea of himself may be changed or even expanded. Vocations may be tried out in this manner. The whole world of human activity may be made more real by trying it all out in the relatively harmless form of the day dream.

Dreams (in sleep). This last form of imagination has certain characteristics which quite definitely distinguish it from

[12] Conklin, Edmund S., *Principles of Adolescent Psychology*, pp. 217-232.

the other forms of thinking. There is for example in the nocturnal dream experience no evidence of problem solving, and there is no awareness of its being related to the actual physical and social situation of the dreamer. It is thus at the opposite extreme from the experience of reasoning where the whole course is dominated by a present problem. Dreams when recalled in the light of waking knowledge appear to us as being amazingly absurd; but it should also be observed that at the time of the experience of the dream its content is not experienced as absurd. This absurdity often leads to much subsequent comment and perhaps the frequent telling of the dream experience. More thoughtful observation of one's dreams will reveal also the dreamer as seldom an active participant in the affairs of the dream. He is far more often a passive observer. This is well exemplified in the ancient phrase, "a dream appeared to me." The content is also largely visual and auditory, usually far more visual than auditory. Other forms of imagery play a much less significant part as dreams are commonly reported.

The relationship of dreaming to the age of the individual is probably of considerable significance. When children first begin to dream, no one knows for sure; but there are often in fairly early years disturbances of sleep which make the observer think that the child has been disturbed by a dream. Dogs and cats also manifest activity in sleep which makes their human associates say that they are dreaming. But, unless we are totally mistaken in our belief that dreaming is a form of imagination, it must be true that dreaming is impossible until after a considerable establishment from perceptual and sensory experience has taken place. Of dreaming in childhood there is no question of fact, although there are questions about the content of children's dreams and of their motivation. So far as we know children's dreams are far more about things they would like to have, to do and to be. Along with these, fear dreams come into prominence in later childhood. Adolescence with its ever-

broadening range of waking experience manifests a comparable broadening of the range of dream content.

That dreams manifest a form of imagination only remotely related to the affairs of the present is easy to understand. There remains, however, the question of the actual motivation of dreaming while the individual dreamer is asleep. The trend of conclusions from studies of the subject in recent years points to the probability of there being many different possible motivations of dreaming. Sometimes dreams are aroused by an intruding stimulus from without or within the organism. A noise, a flash of light, some peculiar fold in the bed-clothing, a little smoke blowing through the room, a touch of indigestion, pain of some sort, may all be stimulating factors in setting up dream activity. The dream is thus a course of activity aroused by one or more of these stimuli and is to that extent related to the outside world; but that does not mean that the dream is a form of imagination governed by the realities of the present situation. The stimuli mentioned appear as intrusions upon the sleeping state of the brain and the dream activity is a relatively isolated course of response to these intruders. The course of the dream is thus governed only by the nature of the brain patterns stimulated. This is often termed a course of free association. But they cannot be completely free because they are in a brain in which are the impressions and patterns established by years of experience. Smoke may thus stir a dream of fire and drops of water on the forehead may arouse dreams of perspiration-producing activity.

It seems also well-demonstrated that there are other and more internal stimuli for dreaming. Sometimes the activities of the day or the evening before carry over and cause dreaming. The person who has studied hard during the evening in preparation for an examination and retires late, perhaps considerably worried over his actual or supposed lack of readiness for the test, will often dream horrible things about tests and examinations. Such a carry-over into

sleep is termed perseveration. But there is ample reason for believing that many dreams are aroused and motivated by wishes or desires. Poor children and orphans dream much about beautiful homes and toys and so on. These appear to be wish-fulfillment dreams. Delinquent children confined in reformatory institutions dream much of home and of life outside. Probably such dreams of a direct wish-fulfillment nature appear also in mature years, although they seem to be far less frequent then than in childhood.

There is a widespread belief that many dreams, especially in adults, are motivated by a wish which is not directly expressed in the dream. The nature of the wish is supposed to be concealed by influences within the person which prevent a direct expression. In such cases something makes the content of the dream actually misleading. The true motivation is said to be vastly different from what one would assume from a knowledge of the dream as the dreamer recalls it upon waking.[13]

Review. Thinking, it will be recalled, has been presented as including a vast range of human activities from the development of concepts and the solution of problems by reasoning to the relatively unproductive activities of dreaming. All this has been seen to be an outgrowth of sensory-perceptual experience and like it to be at its best a means of expanding the knowledge of the growing individual. As a consequence of thinking, in all its forms, one is better able to meet the situations of life effectively. One has as a consequence more ways of responding. If the situations calls for problem solving, one has the necessary resources for reasoning; if the situation does not call for problem solving but for inner activity to prevent boredom, one is able to

[13] For more details about dreams and dream theories see the following:

Blanchard, P., "A Study of Subject Matter and Motivation of Children's Dreams," *Journal of Abnormal and Social Psychology*, 1932, 27, 172-178.

Conklin, Edmund S., *Principles of Abnormal Psychology* (Rev. Ed.), New York, Holt, 1935, chap. XVII.

Kimmins, C. W., *Children's Dreams*, London, Longmans, 1910.

play with ideas, to meditate, to day-dream. Ordinarily little effort is necessary to provoke these different forms of thinking in the developing child; but if they do not appear readily then it should be obvious that every possible effort to stimulate them would be amply justified.

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Chapter XII

ATTRIBUTES OF BEHAVIOR

An individual's behavior at any moment or in any situation is not the result of merely one psychological aspect or function operating to the exclusion of all others at that moment or in that situation. A given behavior may involve basic motives, feelings, perceptions, thought, memory, attention, interest, attitudes, or any combination of these and other aspects. In behavior, all relevant aspects interpenetrate and are intimately involved. Our topical discussion of experience and behavior, therefore, is not to be taken as meaning that psychological aspects and functions can operate individually or be neatly and independently arrayed for inspection. Division and separate treatment of these aspects simply enable us to deal more adequately with the various factors as components of a situation and behavior.

The Nature of Attention. A person's mental growth proceeds through experiences and behavior in situations in which he responds. These experiences must be clear and vivid; that is, attended to; for, obviously, attention is necessary before a response can be made. A person does not respond or behave to everything in his environment; his behavior is, rather, selective. Even the infant's behavior is selective, though there are relatively few objects in its environment to which it attends, and though these are not discerned in detail nor with the precision that will characterize later behavior. However, in its relatively gross way, the infant responds to certain sounds (e.g., the mother's voice), to certain visual stimuli (e.g., the mother's face), to certain tactual and olfactory stimuli (e.g., the nipple and the milk

of the proper quality). For some persons, an environment is richer and fuller than for others; and for the former, therefore, there are in the environment more items to attend to. When conditions of the environment and the individual are such that objects and their structures and organizations are observed, in whole or in part, we have a state of attention. Thus attention is not a mysterious faculty which clarifies an experience for us; instead, attention means that the individual is perceiving in his environment something that for him is relatively well-defined (called the *figure*) against the rest of the situation (called the *ground*). The figure is the relatively distinct particular item, thing, concept, sensation, or what-not that is perceived at the moment; and the ground is the rest of the situation, relatively vague and undiscerned, in which the figure occurs. The figure is not perceived independently of the ground; for the two constitute the entire experience. For example, one may be alert to and perceive certain sounds, colors, forms, etc.; but these do not occur in isolation. The particular items are the figures which exist in a context; the context is the ground, or background. From this it follows that attention is characteristic of all experiences, for they consist of a clearer unit, the figure, against a background which is less clear and less differentiated.

Attention and Education. The process of education, fostering mental development, consists in large part in promoting conditions favorable to the experiencing of good, clear-cut figures, so that one's world becomes more clearly and precisely defined for him. That is, what was to begin with a relatively homogeneous and undifferentiated environment, becomes richer in details, relationships, and meaning. To the untrained or immature eye most trees look alike; all grass is just grass; different types of insects, dogs, horses, etc., are not distinguished; less obvious architectural differences go unheeded; all modern music is "modernistic." Learning and mental growth require that something which before was

indifferent (part of the ground) shall now become a clear, detailed figure, raised from relative obscurity of the background. Sometimes this occurs spontaneously through maturation and experience. But the experience and training of the teacher help the desired items to define themselves for the learner. It is one task of the teacher so to regulate the situation that it suits the intelligence, interests, and motives of the learner. The pupil then actually helps to teach himself.

Even relatively simple situations cannot be expected to hold young children for long, due to their immaturity and limited range of interests. For older pupils, attention is longer, since there are for them more numerous significant details with which to deal. For example, a construction set for a young child is only something to pile up or to bang with; whereas for an older child there are numerous patterns to be made, and the construction units themselves are materials to be investigated. Again, the trained statistician can concentrate upon a page of data because for him there are sufficiently numerous patterns and meanings to allow rumination and still not stray from the subject. The nonstatistician finds little to hold his attention; for him the page of data is an undifferentiated mass.

Through mental growth, then, broad, relatively crude perceptions are analyzed into their more detailed and varied features. The education of attention is concerned with two things: (1) the disposition or readiness of the observer who must hold himself to the task; he must have a "set"; and (2) the structure or organization of the object observed, which can be so constituted that relevant data, ideas, items, and so on, readily stand out; otherwise only the most favorable conditions or a fortunate chance will bring out the things needing attention.

Pedagogically, this means, first, building up dispositional readiness for certain perceptions and forms of behavior; and, second, fitting objects, experiences, and behaviors to the

level of the learner's psychological development. A gradual refinement and expansion of the learner's readiness go hand in hand with the refinement and increased range of the objects discerned and clarified. In the broadest sense this means that it is the task of education, by appropriate means, to make the selected objects and situations more meaningful and significant than they would be spontaneously.

"Spontaneous" and "Voluntary" Attention. Psychologists ordinarily speak of two kinds of attention: spontaneous (primary) and voluntary (secondary). But the distinction should not be taken too literally; for it is difficult or impossible to know where one ends and the other begins. And, further, the voluntary may evolve from the spontaneous, and itself become spontaneous. Spontaneous attention is said to be involuntary and automatic, whereas voluntary is active and must be willfully and purposefully applied. The distinction, however, is just as artificial a one as that between nature and nurture, because it assumes that there are certain aspects of one's environment to which one "naturally" attends, and others to which one is educated to attend. Such a viewpoint ignores the true character of growth. Consider the following illustration suggested by Ribot.[1] A child resists learning how to read; he will not or cannot attend to or concentrate upon the printed symbols which have no interest for him. We say, then, that the child is not motivated to learn because in these printed symbols there is nothing inherently significant for him. Yet he will examine a picture book eagerly and long. He asks what the pictures mean, what the objects are, what the animals are doing, etc. But the parent or teacher, instead of reading the descriptions and thus satisfying the child's curiosity, replies steadily that the way to find out is to learn to read. The child slowly, and at first reluctantly, begins the task. As time passes and as he apprehends the value of reading in opening new vistas,

[1] Ribot, T. A., *The Psychology of Attention*, Chicago, Open Court, 1911, pp. 29 ff.

the child is eager to read. Reading has not been superimposed arbitrarily, but has been made functionally significant to him by an appeal to his interests.

This newly acquired interest in and attention to reading has been called voluntary attention by some. But it must be noted that after reading has become a customary behavior, when we spontaneously turn to verbal descriptions and expositions, our attention is just as spontaneous as it was at an earlier age when pictures rather than printed words were significant for us. The artificiality of designating two kinds of attention is further revealed when we recall that an infant of six months or more is not spontaneously attracted by pictures; and that a precocious child *wants* to learn to read at an age when average and duller children are spontaneously attentive only to pictures. The artificial division of attention into spontaneous and voluntary and its attendant difficulties disappear when we regard attention not as an entity or a force but only as a characteristic of behavior, signifying that for the individual certain aspects of the environment stand out and are for the moment the focus of his perception and behavior.

In the same situation, different aspects will be attended to by different persons. A physician who is a skin specialist is predisposed to observe (pay attention to) and interpret every skin blemish which goes unobserved by a layman unless it is extreme. A psychiatrist is alert to idiosyncrasies of behavior seemingly unimportant to other persons unless the idiosyncrasies obtrude themselves. A bridge engineer is attentive to forms of construction, the existence of which is even unknown to the untutored. Naturally, then, a child cannot be expected to be alert to the same aspects in his environment as his parents and teachers; nor to show enthusiasm over the same learning problems. These differences are the result of differences in maturation, education, and experience, and consequent differences of interest and functional significance in one's enviroment.

A Negative Aspect of Attention. Attention has its negative aspect as well. The illustrations in the preceding paragraph indicate that certain aspects of a situation are heeded because they have *functional value* for the individual. That is, they are meaningful and significant for him. On the other hand, objects or aspects of a situation will go unheeded if they have no functional significance for the observer, even though they might have been often repeated and experienced. For example, if one lives on a noisy street, he will at first give attention to the street-cars or automobiles as they rush past; but after a fairly short period, for most persons, the vehicles go unheeded. They were at first "figures" on the "ground"; but later they became part of the ground. This is an instance of *attention shift*, first, when one has to make an effort to keep the noise "out of mind," and, then, of *adaptation* when one no longer heeds the noise. Should this same person return to live in quiet surroundings, he would at first heed the *absence* of noise.

Learning to write (or, in fact, any motor skill) is another case in point. At the beginning of the process, the focus of behavior is the *act* of writing itself. The position of the body, arm, hand, pencil, etc., and the writing movements occupy the learner's attention. But after the act of writing has been mastered—that is, when it has become established as a habit—it is no longer in the focus of behavior. Instead, the act of writing becomes merely part of the background of a total behavior in which the words or ideas to be written are attended to. Similar conditions will be found in the mechanics of learning to play tennis, golf, the violin, the piano, and so on.

Conditions and Determinants of Attention. Having presented the more important general characteristics of attention, we may now turn to a consideration of specific conditions and determinants which have been subjected to laboratory experiment.

In a state of attention there are characteristic bodily signs

which indicate that a person is attending. The brow may be wrinkled; the muscles of the jaw may be set; and the fists may be clenched. All muscles are slightly tensed; whereas in non-attention they are relaxed. The person who is attending may hold his breath and inhibit superfluous body movements in order to avoid distractions. Where vision is involved, the eyes are fixated. Where audition is involved, the head may be turned and held in a fixed position. These patterns, or sets, not only indicate that a person is attending; but they are the cause of the sensations of effort and strain experienced by the individual himself in the situation. The individual not only tries to apprehend what is relevant in the situation, but he tries also to exclude the irrelevant and distracting; for he may shut his eyes, or cover his ears, or turn away his head. Furthermore, the organism undergoes certain internal changes when in a state of attention; such as changes in depth of breathing, blood pressure and circulation, and glandular activity.[2] These internal and external bodily conditions signify that a state of attention is an active form of behavior, that attention means doing something, and that attention involves sensory-motor behavior.

The conditions of a situation arousing or favoring attention may be divided, for convenience, into the objective and the subjective. Objective conditions are the characteristics of the stimulus, while the subjective are those of the experiencing and behaving individual.

Included in the objective are: (1) strength of the stimulus, such as intense sounds, bright lights, and strong odors which force themselves upon the experiencer's attention; (2) large objects, which ordinarily are more attention-compelling than small; (3) increased duration of stimulus, for whereas a faint stimulus will not be noted if it is of short duration, prolonged duration will bring it into awareness; (4) repetition of stimulus, for whereas a faint stimulus may be ignored

[2] It is probable that these internal changes are evidences of the presence of feelings or emotions in a state of attention.

if it is repeated only a few times, it will be noted if applied time and again (this is, of course, related to duration); (5) change, as in change of pitch or intensity of sound, change of motion, temperature, pressure, light intensity; (6) unusual qualities, as in shape, color, design, manners and customs (of people); (7) definiteness of form and organization, as contrasted with the vague.

In connection with the fourth of these conditions—repetition—it should be noted that in some situations frequency of experience results in monotony and adaptation, whereupon attention ceases. The faint ticking of a clock after a time intrudes itself; but after another period one becomes adapted to it, and the ticking is no longer heard. This is the negative aspect of attention discussed above. It should be observed, also, that frequency of experience with something that was unusual to begin with will make that thing *usual*, and will thus deprive it of its earlier attention-compelling qualities. For instance, on arriving in a strange or foreign community, we are impressed by (attend to) the newness of the people's traits and of the architecture, let us say. But frequent and intimate association with the strange or unusual makes the formerly novel conditions commonplace; they are no longer the focus of attention.

Under subjective conditions of attention we may follow the general classification set down by W. B. Pillsbury: [8]

1. *The ideas or impressions in the mind at a given time.* For example, if one is thinking of colors and color combinations while walking in the country in the autumn, he will observe the richness and variety of color in the foliage which otherwise would escape him. There is thus a tendency to observe such matters and things as are consistent with a general mood or direction of thought.

2. *The purposes or attitudes of the moment.* This, a purposeful or predetermined set, is different in degree from the preceding condition which is a somewhat accidental deter-

[8] *The Essentials of Psychology*, New York, Macmillan, 1930.

minant of attention. As an illustration, consider a proofreader who is intent on detecting errors of spelling, punctuation, grammar, etc., but who excludes from his observation many or most of the ideas in the materials he reads. This condition signifies that what one attends to in a given situation is conditioned in part by a prepared set or attitude.

3. *Previous education.* This simply signifies that a person's attitudes, interests, and purposes—as manifested in vocational, social, and avocational matters—help direct his attention into certain activities rather than into others. And since attitudes, interests, and purposes are to an important degree products of education, the rôle of education in attention is apparent. It is scarcely necessary to indicate, for example, the different impressions and recollections that will be brought back from, say, a visit to Paris by a fashion expert, a student of art or architecture, a gourmet, or a student of ethnology.

4. *Duty, or social pressure and influences.* This condition is not altogether unlike the preceding one; for social pressure and influences are educative forces in matters of attitudes and interests. But the justification of setting this up as a separate condition is found in the fact that people are socially induced, or coerced, to attend to a variety of objects or events which they might readily ignore if their own individual preferences were the determinants. The home, church, club, political party, business groups, etc., all play their parts.

5. *Sensory and physical capacities.* The rôles of these conditions in attention are exemplified in the following instances. A child or an adult who has unusually good auditory discrimination is more prone to attend to music and its finer nuances than is a person with poor auditory discrimination. Color-blind persons or those with seriously defective vision will very probably not attend to paintings, nor to fine fabrics and their patterns. There is a greater probability that a boy with a strong physique will be attracted to sports

than will a frail boy. Though sensory and bodily capacities are not the sole determinants of interests and consequent attention, they do play their rôle.

Dimensions of Attention. The three dimensions of attention to which a great amount of consideration and experiment have been devoted are *range, span,* and *duration.*[4]

In connection with range, the question is this: Can a person attend to and do more than one thing at a time? We all know that we can talk or even read while walking. We can think over some problems while driving an automobile. But these situations, and others like them, are not valid illustrations; because walking is not being attended to in the first instance, nor is driving in the second. Both are automatic forms of behavior. Laboratory experiments have answered the foregoing question in the negative; for, in what appears to be an instance of attending to two things at the same time, the person actually is shifting back and forth rapidly from one to the other. It has been shown, furthermore, that often both performances are disturbed and less effectively done.

Span of attention raises this problem: How many objects can an observer apprehend in a single momentary exposure? The answer to this question is that normally attention is unitary; there is no attention to two distinct things at the same time. This does not mean that two or more objects cannot be apprehended at one time; but it does mean that if they are to be apprehended, they must enter into some kind of unified pattern or organization. Otherwise, there will be rapid shifts of attention from one to another in an effort to encompass them all. Experiments with black dots on a white background, for example, have shown that span depends upon the extent to which the dots can be grouped into patterns. Also, in reading we do not note every letter in a word; we note, rather, its general form, often overlook-

[4] For a summary of experiments on these problems, see Woodworth, R. S., *Experimental Psychology*, New York, Holt, 1938, chap. 27.

ing a misspelling, or even misreading the word. If a number of dissociated objects were spread out on a table and observed for a few seconds, it would be very difficult later to specify these items. Yet, if the same number of items made up a pattern or if they possessed some kind of inherent relationship—say, the parts of a carburetor, or the pieces of attire in some sort of "outfit"—they could be apprehended in a single momentary exposure by a person who perceived the pattern or relationship.

Regarding the problem of duration, the question is this: For how long a period does a person attend to a stimulus? The answer is that duration depends upon the nature of the situation and of the person attending. It is known, for instance, that in the case of faint stimuli, such as the ticking of a watch or a faint gray ring on a revolving disk, a person does not attend steadily. The gray ring will be seen for one or two seconds; then it will vanish for four or five; then it will return. The ticking of the watch behaves in a similar fashion. These changes are known as "waves" of attention. These very brief waves, however, are not characteristic of all behavior. A good book or a good lecture will hold our attention for long stretches of time. But in these instances, the material is constantly changing and developing; we are not attending to one and the same stimulus throughout. Furthermore, we should note that a good speaker introduces periodic pauses when attention might lapse; and he uses various devices to jerk auditors back into an attentive state. That duration is in part dependent upon the nature of the situation is further shown by reports that in reading difficult materials, students are able to attend continuously from fifteen to thirty minutes, after which distractions begin to make themselves felt. Duration of attention, then, depends upon the nature of the objective situation and upon the individual's interests and purpose. Duration is prolonged if the situation is dynamic rather than static; it is prolonged if we can attend continuously to a developing situation.

Educationally, the most important fact of attention is this: a situation or aspects thereof which are functionally valuable —that is, significant and meaningful to the individual concerned—for whatever reason, will be attended to. Those not functionally valuable either will not be heeded at all or will go unheeded after their initial attraction resulting from the factors discussed above.[5]

The Nature of Interest. Interest and attention are really inseparable; they are just two aspects of a process of behavior, and they develop simultaneously. In fact, at times one is defined in terms of the other; as, for example, when interest is defined as "a feeling which accompanies special attention to some content"; or as "a term for certain complex conditions of attention"; or as "an attitude characterized by focusing attention upon certain cognitive data."

The term interest has been defined in other ways as well. Dewey states it is identifying one's self with the activity; a firm, growing attribute of the individual and his purposeful activity. William James held that interest is a liking for and an inner urge toward some worthy end in the eyes of the individual. Other writers have identified interest with feelings of pleasantness and unpleasantness; whereas still others have made interest synonymous with motives. Finally, interest has been regarded as correlated with ability; that is, we like to do (are interested in doing) those things we are able to do; learning is facilitated in things we like to do; skill, information, and appreciations are in part the product and in part the cause of interests, the relationship being reciprocal.

The foregoing definitions are not mutually exclusive. Examination will show that they differ in point of emphasis, or they use different terms to express fundamentally similar concepts. These variations in definition also illustrate the impossibility of singling out any one concept, like interest

[5] In connection with attention, the student should refer again to the chapter on Perception, especially the discussion of visual perception of space.

or attention, and regarding it as an entity having independent existence. For an individual's interests are the result of his developmental history, his capacities and abilities, his purposes, and, in general, of the cultural pattern influencing and directing these. If interests and attention may be contrasted, the distinction is simply this: interests are relatively lasting; they have a relatively enduring quality, whereas attention is the directing of one's behavior toward the things and situations of interest. The two may also be contrasted in this way: specific interests become characteristics or qualities of an individual, whereas attention is a temporary attribute of behavior.

Interests and Education. Obviously, it is one very important function of the educative process to emphasize the permanent values of experience and behavior. That is, abiding interests will be sought rather than the mere formation of mechanical habits of behavior or the cultivation of a doubtful "discipline of the mind." In our discussion of motivation we pointed out that a child is capable of many and varied spontaneous activities within its environment, and that the basic motives to behavior are the springs of action and learning. Thus educational activities intended to contribute to or develop interests must be congruent with the learner's stage of maturation and motivation, his past experiences and behavior. That is to say, his existing stage of development and his level of perception must be such that he can truly apprehend the ends sought by means of the educative processes being employed.

Interests are developed, first, through concrete sensory experience; through direct and vivid situations, rather than through the vicarious and the abstract to begin with. It is impossible, for instance, for a child to develop an interest in mechanical performances if he has not had first-hand experiences in the manipulation of mechanical materials. Merely talking about them will not suffice.

Interests, however, even in the case of a child, need not

be limited to those objects and situations which are immediately perceived as interesting; for, as has long been recognized, objects which are even not interesting in themselves may become so through association with other objects and activities which are already interesting to the individual. For instance, a child at first engaged in playing "store" may, as a result, find the study of numbers attractive, since numbers have a functional value in the game. A musician, interested in types of instruments and their tones, may come to extend his activity to the historical study of instruments and their periods. In this way interests expand and multiply. This principle of transference and extension is equally true of objects, values, and goals of behavior which are not interesting in themselves but which are accepted and sought because they are associated with or attached to the satisfaction of basic motives. In such instances it is the satisfaction of the allotted motive that stimulates behavior, and not the intrinsic quality of the object or situation itself. Consider, for example, the instance when a child learns certain assigned lessons in order to get the approval or avoid the disapproval of parents or teachers; or when an adult works at dull, routine, and tedious tasks to acquire money to satisfy his own and his family's wants. In these instances intrinsic value and spontaneous participation are lacking.

"Measurement" of Interests. Within relatively recent years attempts have been made to obtain objective measurements of children's interests,[6] since the genetic approach is most important for educational purposes and indeed for an understanding of adult activities. These objective studies are really not "measurements" in the ordinary meaning of the term, even though numerical scores are obtained. They employ the test or questionnaire method to determine children's interests in intellectual, social, and physical activities; interests in types of play and in making collections. The justifiable assumption is that actual behavior of a voluntary

[6] See Fryer, D., *The Measurement of Interests*, New York, Holt, 1931.

kind is the best indicator of a child's interests. It was found, in general, that these varied with the factors of age, sex, physique, health, temperament, home and community environments. This is what we should expect, of course; for, as we have already pointed out, interests are not independent entities; they are manifestations of behavior, determined by needs and abilities functioning within a given cultural setting.

Development of Interests. As in so many other matters, the question of inheritance and environment has been raised in regard to interests. The answer must be the same as in our discussion of intelligence and individual differences. It is not merely a matter of one *or* the other when a child, sufficiently matured, evinces an interest in crayons, pencils, and paint brushes; in music, science, lethal weapons, or poison gas masks; in books or animals; in hunting or in an automobile or radio set. The same child at the same age, in another society, nation, or even generation, might have established interests of an entirely different sort. Certain interests and activities would, in fact, have been impossible, owing to the absence of the necessary environmental influences (as, for example, scientific interests in the seventeenth or even eighteenth century).

It is neither an accident nor a matter of biological differences that we find the interests of boys to be in athletics or gadgets in one society or nation, while in another they are in arms, uniforms, and organized festivals. Nor is it simply a matter of nature *or* nurture that within the same community interests of children and adults show variations. The child's degree and kind of development determine what aspects of the environment will be significant for him; the general pattern and the details of the environment will give specific direction to his further development in the acquisition of interests, as in all other learning.

To an undetermined degree interests undergo change as the individual develops from childhood to adulthood, par-

ticularly in specialization and detail. It would be surprising if this were not so; for during the developmental period the individual is having new experiences and insights; his capacities and abilities are increasing; the purposes of his behavior are changing; and more remote objectives of behavior are operative. At the same time there is evidence showing that to an appreciable degree the foundations of adolescent and adult interests are to be found in childhood; as, for example, in matters of vocation, religion, subjects of study, recreational and social activities. Development and changes of interests, then, are evidences of maturation and environmental influences operating as a single process of growth.

Although adult and adolescent interests often have their roots in childhood, it is not to be supposed that these interests are not subject to modification; nor is it to be assumed that new interests cannot be created in adolescence and adulthood. Provided always that an activity and interest are within an individual's range of abilities, new interests may be created under appropriate conditions. And also under appropriate conditions, old ones may be modified or eliminated. E. L. Thorndike in a series of experiments [7] recently showed that this is the case. He concludes that interests can be cultivated as more or less permanent features of a person's make-up in several ways: either through the intrinsic character of the activity itself, or through the stimulation furnished by external incentives—such as desire for money or fame—which will satisfy some motive to behavior. It must be noted that these incentives are means of satisfying basic motives. These same motives, however, may be satisfied in other ways. If, for example, intelligent or rational or scientific or non-aggressive behavior brought social approbation, these behaviors could be substituted for the gathering of wealth and for competitive aggressiveness. Thorndike recognizes this in his conclusions. He emphasizes, in both inter-

[7] *The Psychology of Wants, Interests, and Attitudes*, New York, Appleton-Century, 1935.

ests and attitudes, the importance of satisfactions to be derived from doing that which yields pleasantness; and pleasantness is to be understood in terms of basic motives. Fixed ways of behaving (including interests and attitudes) are sustained because they habitually give satisfactions. The task of education, therefore, is so to develop the individual that he will have such interests and attitudes as are valued, thereby yielding satisfactions, rather than others.

Formation of Attitudes. An individual's behavior at any time is the product of a complex organization of functions operating at that time. Yet it is found that in certain types of situations a person's behavior has a high degree of consistency. This consistency, or disposition to respond in a relatively definite manner to all objects and situations with which the response is related, is called an attitude. For example, a person rather consistently supports and votes for the conservative (or liberal, or radical) side in political and economic controversies; one person may be deferential to authority, whereas another person may be defiant; one person may be self-reliant, whereas another may be dependent upon others. There are, of course, degrees of these and all other attitudes; they are not a mere two-fold division. But the point is that the degree is rather consistent within an individual over a relatively long period of time, especially in adolescence and adulthood, for as a person grows older he tends to become more resistant to change, though not necessarily consciously so. Diversity and inconsistency of behavior are found much more frequently in children and younger adolescents, since their attitudes have not as yet become relatively fixed.

Attitudes develop like all other aspects of behavior; they are the effects of actual situations. Children are not "by nature" predisposed to a definite attitude with respect to religion, politics, other nations, "foreigners," scholarship, money, etc. The particular readiness or disposition to respond in a rather typical manner to these and other situa-

tions is the product of education in its broadest sense. Attitudes, then, are really particularized tendencies or dispositions to behavior that have been evolved from the motives already discussed.

Attitudes arise from actual, concrete situations, which, after a time, are generalized. Later, the generalized attitude is active in specific situations of the proper type; but the individual, in his behavior, need not be aware of any specific reference to previous experience. In our recall of experiences contributing to the formation of attitudes, the mistakes, omissions, and fading are those of specific content but not of general impressions. In this connection, our discussion of forgetting is relevant, wherein it is indicated that the first impression tends to be lasting; significant details contributing to that impression are lasting, whereas other details are forgotten or distorted to conform with the impression.

Attitudes in time come to direct our behavior without our necessarily being aware of their source; nor do we, in fact, feel the need of determining the source. Not all attitudes, however, are of the same strength. Some, therefore, are more significant in behavior than others. For example, a strong anti-radical or anti-reactionary attitude, a pervading and strong religious or anti-religious attitude—these will be more powerful in directing behavior than, let us say, an attitude of obedience, or one of study.

It has already been stated that specific attitudes are the resultants of environmental forces. In early life, of course, among the most important of these forces are the other children and adults with whom the child comes in immediate contact. As the individual grows older, "pressure groups," in school and out, begin to make their influence felt in the formation of attitudes. Also, attitudes are influenced by what is called the "halo-effect." That is, some persons, institutions, or organizations held in esteem for one reason or another will influence attitudes on matters in which they are no more qualified to speak authoritatively than are many

others of lesser reputation; but they are listened to and followed because of competency or esteem in *other* fields, which, however, does not qualify them in matters irrelevant to their own fields of specialization and authority. For example, a distinguished physical scientist broadcasts his economic views, and they receive a respectful hearing, although they may be sophomoric from the point of view of the technical economist; cigarettes, cosmetics, automobiles, and other products are advertised (and sold) because they are endorsed by famous athletes, society "leaders," or "movie" actresses who, in fact, know nothing about them. Products are also advertised and sold merely by associating them with the portrait of a spectacularly beautiful young woman whose qualities, apparently, are attributed to the product.

Modification of Attitudes. To an unknown degree, attitudes are modifiable, the extent of modification being dependent upon a number of factors. Among these factors are the amount and kind of knowledge available at the moment, society's evaluation of that knowledge, the age and intelligence of the person, and the purpose of his behavior. If the school, therefore, is in a position to present all relevant knowledge, at the proper stages of the child's development, and in such a way that it seems significant to the learner, it is to be expected that desirable attitudes, as construed by the schools, can be established, provided the school's efforts are not frustrated or counteracted by contrary experiences and teachings in environments outside where, after all, children spend the greatest portion of their time. In fact, the effectiveness of teachings in institutions of formal education is reduced in greater or lesser degree by the disparity and conflict of attitudes existing between these institutions and their communities or nations.

Teachings, in the school and outside, are much more effective in shaping and directing attitudes if the ends sought (the attitudes) are made explicit and if the instruction is systematically directed to those ends, rather than if the atti-

tudes are expected to emerge incidentally.[8] Attitudes, of course, cannot be established without a foundation of concrete experiences or information (correct or distorted). But the specific experiences and by far most details of information will be forgotten, whereas the attitudes are the residuals, the more or less enduring outcomes of education. Many children grow up with an attitude of horror of giants and admiration for "princes" and fairies without recalling the precise fairy tales read to them or by them. These attitudes may persist even long after the individual's intellect recognizes their unreality. The materials and methods used in teaching history determine children's attitudes toward their own and other nations, toward a variety of social institutions and concepts, through the perpetual reiteration and glorification of selected materials and principles (e.g., war, victory, heroes, conquest, superiority, etc.). The attitudes endure as the more or less permanent effects of education, though little factual information may remain.

Experiments have demonstrated that children's attitudes can be modified for better or worse by motion pictures; as, for example, those toward the Chinese and the Negro, and toward gambling,[9] the amount and nature of the changes, naturally, being dependent upon what those attitudes were to begin with. When, however, the situations producing the changes are discontinued, there is a regression toward the previous status, or point of view. Thus, it appears that continued experiences are necessary if permanent or significant changes are to be achieved. It is not surprising, therefore, to find that one of the first steps taken by a dictatorial and regimenting government is to assume rigid control over the methods and content of instruction in schools and universi-

[8] See Saxby, I. B., "Some Conditions Affecting the Growth and Permanence of Desires," *British Journal of Psychology*, vol. 9, 1917, 98-149; also, Peters, C. C., "Some Techniques for the Quantitative Study of Values of Learnings," *Journal of Educational Sociology*, vol. 7, no. 4, 1933, 213-72.

[9] For example, Thurstone, L. L., "Measurement of Change in Social Attitude," *Journal of Social Psychology*, vol. 2, no. 2, 1931, 230-35.

ties, and to establish rigid censorship over moving pictures, the stage, and all forms of publication, beginning with nursery rhymes.

"Measurement" of Attitudes. Psychologists are now attempting to devise scales which will "measure" or, more properly, rate individuals in respect to their attitudes on issues more or less in dispute. That is, they would ascertain the degree to which persons regard with favor or disfavor certain specified institutions, groups, or policies; such as the church, national and religious bodies, degrees of militarism or pacifism, degrees of conservatism or radicalism in government, and the like. The persons whose attitudes are being rated are given a list of opinions graded in character from the most to the least favorable with respect to the institution, group, or policy under consideration. Each individual checks those opinions with which he finds himself in agreement, presumably revealing thereby what he thinks, believes, and feels concerning the matter at issue. The checked items are converted into a score, and the individual's degree of favor or disfavor is ascertained.

For example, with respect to the church, the following are among statements that appear, varying in degree of approval or disapproval: "I believe church membership is almost essential to living life at its best"; "I believe the church is the greatest influence for good government and right living"; "I believe in religion but I seldom go to church"; "I think the teaching of the church is altogether too superficial to have much social significance"; "I think the church is a parasite on society." [10] Thus attitudes toward the church—or anything else—form a gradation from one end of the scale—complete acceptance and approval—to the other end—complete rejection and disapproval. It is important to note that attitudes toward anything do not divide themselves into just two opposing groups. Attitudes exist, rather, as "more or

[10] Thurstone, L. L., and Chave, E. J., *The Measurement of Attitude*, Chicago, University of Chicago Press, 1929, pp. 60-63.

less"; that is, in various degrees positive or negative, or neutral.

For purposes of measurement, or rating, the "attitude variable" must be restricted and explicitly stated, and specific situations must be used to represent that which is to be rated. Attitudes cannot be measured in the abstract. The individual's rating having been obtained by means of these specific situations, it is assumed that the rating represents that individual's general attitude toward the institution, group, or policy under consideration; and that this general attitude will carry over to and affect later specific situations in the same category (unless, of course, changes have taken place through education).

We have stated that the attitude variable must be restricted for purposes of measurement. By this we mean that we do not rate liberalism or conservatism in general, the scientific or unscientific attitude in general, etc. The best of this type of test thus far devised restrict themselves to single fields, such as liberalism or conservatism of political views, militarism—pacifism, religious or non-religious attitudes (in the ordinary meaning of the terms). In fact, it would probably be unsound to attempt to measure all-inclusive attitudes; for an attitude may change as the situation changes. For instance, a man may be honest in his business and, at the same time, dishonest on the golf-course; or *vice versa*. Another may be scientific in his approach to his experimental problems, yet unscientific in his social, economic, or religious views. Still another may be generous with his family but petty with his employees. A boy will cheat in the school room, but he may be quite honest in games.

The educational ideal, of course, would be to develop desirable attitudes so generalized in character as to pervade every field of activity. But since attitudes do not operate in a vacuum, their proper functioning requires an appropriate setting. For example, if attitudes considered desirable by and developed in the schools are in conflict with those in

the community outside, the former will be effective in the schools, but not necessarily elsewhere.

We must note one defect which is inherent in the very nature of tests of attitude; namely, they are "pencil-and-paper" expressions of opinions; and that is not the same as an actual situation requiring overt behavior. In other words, we may distinguish between what might be called the "intellectual," on the one hand, and the "behavioral" or overt attitudes, on the other. The usual test shows the individual's state of mind with respect to a policy, group, or institution; it does not show what he will actually do when confronted by a situation demanding overt action, though there is, of course, a degree of consistency between the intellectual and the overt. Still, a person might have certain attitudes, believing them to be proper and justified, yet circumstances may direct his behavior otherwise—as when an ordinarily honest and peaceful man, as a last course, steals to provide for his family. Educationally, however, it is significant to know the extent to which children and adults hold certain viewpoints; for desirable behavior is contingent, among other things, upon an apprehension of what *is* desirable.

The Nature of Feeling. The objects and situations to which we attend, the events in which we are interested, and the attitudes we develop and manifest are not matters of indifference to us; nor are they "pure" mental events uncolored by affective quality. When that affective quality is strong, intense, and widespread, involving mass activity of the organism, it is called an *emotion* (discussed in Chap. V). When, however, the conscious experience is one of pleasantness or unpleasantness, when it is less intense and less diffuse, resulting from internal organic activities more restricted than in the case of emotions, it is called *feeling*. The feeling characterizes the situation as something to be sought or avoided. Thus, emotions and feelings are not sharply distinguishable; they differ, rather, in degree of strength and

extent of organic changes within the experiencing and behaving individual.

It is known that expressions of emotion may include many parts of the body and involve many bodily changes such as: facial expressions, blushing, patterns of bodily movement, verbal response, laughing and crying, changes in the secretion of sweat, changes in blood pressure and blood volume, changes in respiration, changes in the activity of the gastrointestinal system, variations in metabolism, changes in balance between secretions of endocrine glands, and variations in electrical responses.[11] Unfortunately, however, the facts regarding the organic bases of feelings of pleasantness and unpleasantness are little known. But since feelings are milder and less extensive affective qualities than emotions, we may assume that in feelings the same kinds of bodily changes take place, but that they are attenuated and probably fewer in number. These blends of bodily sensations, produced by the bodily changes, *experienced as a totality or whole* in a given situation, are the feelings.[12]

Feelings may, in a sense, be regarded as "educated" emotions, as a result of the individual's experience and maturation, and as due to increased cortical control. Experimental evidence indicates that the part of the central nervous system originally controlling emotions is the phylogenetically old part of the brain known as the optic thalamus. It has been

[11] Cf. Landis, C., "The Expressions of Emotion," chap. 13 in *The Foundations of Experimental Psychology* (C. Murchison, ed.), Worcester, Mass., Clark University Press, 1929.

[12] Most of the bodily changes here enumerated are under the control of the "autonomic," or "involuntary," nervous system, which innervates smooth muscles as well as glands and other viscera. For a brief discussion of its functions see Cannon, W. B., *The Wisdom of the Body*, New York, Norton, 1932, pp. 230 ff.; also his "Neural Organization for Emotional Expression," chap. 22 in *Feelings and Emotions* (M. L. Reymert, ed.), Worcester, Mass., Clark University Press, 1928.

An older view distinguishes qualitatively between feelings and emotions. According to that view the two belong to separate categories. An emotion, it states, has a feeling-tone; but so has a sound or a color, etc. The traditional view regards feeling as a kind of atmosphere in which all experiences, including emotion, are bathed.

demonstrated with cats and monkeys that in instances where cortical control is removed by surgical operation, appropriate stimulation evokes an intense undifferentiated emotional response. Thus it appears that the higher brain centers of the cerebral cortex exercise a dominance over such undifferentiated expressions. Young children are given to not infrequent outbursts of intense rage or fear, during which their behavior is not very different from that of these lower animals. In adult man, however, undifferentiated and uncontrolled outbursts of emotion are unusual under ordinary circumstances. On the whole, the evidence indicates dominance in the superior centers of the cerebral cortex over the emotional centers in the optic thalamus, since withdrawal of cortical influence appears to be a necessary condition for intense, undifferentiated emotional outbursts.[18] These experimental results suggest the increasing importance of maturation and education, in the broadest sense, in the development of feelings. It is one task of education so to direct emotional behavior that it may function as a means to the fulfillment of desirable ends.

Feeling in Behavior. Feelings are inseparable from behavior; they are always part of a situation in which the organism *does* something. As such they are "instruments of evaluation"; for situations accompanied by pleasantness are accepted and sought, whereas those that are unpleasant are rejected and avoided. Unpleasantness, however, is not to be regarded as synonymous with pain. It is known that certain physically painful situations may be psychologically pleasant to the experiencer; as in the cases of the masochist, and the person who castigates the flesh for religious purposes, and the child who invites punishment from parent or teacher as a means of attracting attention or gaining approval of his fellows. In general, objects and situations are colored, psychologically, by the perceiving individual who projects upon

[18] See Cannon, W. B., "Neural Organization for Emotional Expression," footnote 12.

them the feelings which they arouse in him and which they create by producing organic reactions within him.

A given object or situation, however, does not always evoke the same feeling of pleasantness or unpleasantness. The individual's experience will depend not only upon the external stimulus, but upon the circumstances, consisting of his organic predispositions and of the setting in which it occurs. Thus food may be distinctly unpleasant to the satiated person; a selection of sentimental music may be distasteful to a person "disillusioned" in love, or to one who has heard it too often; one's own work, ordinarily absorbing, may become unpleasant under unfavorable conditions; a bright and ordinarily eager pupil may find his lessons intolerable if a competing interest is momentarily stronger.

Wherever feeling is involved, experience is livelier, richer, and more eventful; and the practical outcome of behavior is, to the individual, more significant than it is in the dryer, more casual atmosphere of indifference or neutrality. Indifference and neutrality are manifest when behavior lacks spontaneity, when it lacks vitality, as it will in routine habits and mere casual observations.

Feelings and Learning. Learning is a form of behavior. We have already stated that pleasantness is correlated with a positive attitude of acceptance and seeking, whereas unpleasantness is correlated with a negative attitude of rejection and avoidance. It is a truism, therefore, to say that, as such, the states of pleasantness and unpleasantness are important in learning in general, and in school in particular.

Unfortunate, and consequently unpleasant, experiences in the school, as well as elsewhere, influence the child's feelings and attitudes and may spread to the entire complex situation with which these experiences were first associated. Memory of the actual unpleasant experiences itself may fade, and in fact disappear entirely; but the *feeling* may persist and even increase in intensity. This is a very significant aspect of behavior, for it helps to explain numerous feelings and atti-

tudes of persons who are unable to specify the reasons for them.

This does not mean that the learner should be permitted to do absolutely as he pleases in order to enjoy himself. It does mean, however, that the school must provide a setting in which the child's basic motives will find opportunity for desirable expression. It is for this reason that at present schools are taking into account and making provisions for individual differences in abilities, for special abilities and disabilities, for those with language, physical, or sensory handicaps, for those with special interests, and for those handicapped by emotional factors.[14] Such provisions tend to foster desirable feelings and attitudes toward the school; that is acceptance and seeking. Disregard of individual needs, results in failure, or in stifling of interests, or in mere routine and casual performance; or it may lead to the more serious consequences of repression and indirect modes of expression, such as compensation, regression, rationalization, or even hysteria. In the disregard of individual needs and basic human wants lies one of the reasons for children's distaste for and rapid elimination from school.

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[14] For a discussion of children presenting problems of adjustment to school and home—and consequent undesirable feelings and attitudes—see Louttit, C. M., *Clinical Psychology*, New York, Harper, 1937.

Chapter XIII

HANDICAPS TO OR DISTURBERS OF DEVELOPMENT

In the preceding chapters much has been presented concerning the nature and course of the development of the normal functions of response. It has been seen that learning enters importantly into them all. The course of sensory and perceptual development has been described and how thinking adds to the scope and detail of response possibilities, to the expansion of knowledge. It is now important to observe that delays, twists, and distortions of development not infrequently appear as the consequence of unusual features of endowment or acquisition. Sensory defect in the form of blindness, complete or partial, of deafness, complete or partial, the development of unfortunate habits such as those of stuttering and left-handedness, and the acquisition of response patterns which seriously conflict with each other, all of these must be recognized because they will be seen in the contacts of everyday life and something of what is known about them be learned.

Blindness. A complete congenital absence of vision is rather uncommon but is the best point of reference from which to think about the more frequent defects of vision which are referred to as partial blindness. One needs but to recall how frequently the factor of vision was presented in the preceding chapters, especially in the development of perception, to realize how very different the course of development must be in the child lacking this important sensory function. Growth must take place in such instances without any assistance from visual memory. There could be no

visual imagery. Perceptions of objects and of place and direction must all be achieved somehow without the assistance of vision. It is difficult for the sighted person to comprehend what the world of the totally blind is like. It is too easy to assume that it is like moving about in the dark. Actually the world of the totally blind must be quite different from that of the sighted person in complete darkness or when wearing a tight bandage. The world of the totally blind from birth is a world in which there are no visual memories and no visual aids for perception. It is as sightless as a sighted person's conception of the other side of the moon. Actually it is even more so because, even though he has never seen it, the sighted person is prone to think of the other side of the moon as somehow like the side which is visible.

That the range of knowledge of the congenitally and completely sightless person must forever be limited by this defect must be obvious. Such a person may learn by analogy and thus approximate something of the knowledge which the sighted person acquires through vision, but the nature of the visual response is something which he can never know by personal experience. That the sightless child should be slow in the acquisition of space perceptions is not surprising. Curiosity, however, leads one further to ask how the sightless child acquires such perceptions at all. So far as we know the emphasis placed upon vision as an aid in the perception of objects, size and distance, is in the sightless person shifted to the kinesthetic associations. The blind child must piece together a space world out of movements through and around and over. Reference must be made to kinesthetic patterns. Thus, far more than the sighted child, must the blind child have opportunity for handling and moving about. One very acute observer, himself blind,[1] notes that for a blind child to learn his way about a dooryard, to learn sizes and relative

[1] Cutsforth, T. D., *The Blind in School and Society*, New York, Appleton, 1933.

locations, some fixed point of reference is necessary. This can best be auditory. A jingling toy or decoration hanging on the porch will serve such a purpose excellently. Starting with the noise clearly audible and moving about the yard patterns of distance and of cutaneous-kinesthetic experience with objects become associated with this noise and the differences of intensity as the child goes and comes and turns about. Thus is the space world developed for the blind through the organization or association of auditory and kinesthetic response patterns.

The consequence of such a perceptual development as that just described must inevitably be that the blind make much use of slight sensory cues, slight changes in sound and in touch and in movement, which the sighted person normally ignores. The sighted person depends upon vision; the blind must use these other cues as substitutes for sight. Perceptions of direction are dependent primarily upon slight features of the auditory experience. Perceptions of persons must likewise depend upon the voice and all of its inflections, far more than with the sighted even, and also upon such slight things as the sound of breathing, of the footsteps, the touch of the hand, and so on. That these are of such great importance can be readily demonstrated by the effect of their absence. A light fall of snow will immediately muffle sound reflection and so completely change the perceptual cues that confusion for the blind is the inevitable consequence. The sounds of a passing brass band affect the blind's orientation much as a brilliant light dazzles the sighted person if shining directly into his eyes. Herein lies the explanation of the popularly termed "sixth sense" of the blind. Actually there is no such thing. They have no sense not possessed by the normally sensed. What is so mis-termed is merely the development and utilization of these very faint cues which the sighted neglect. The blind person knows for example when he is approaching a wall by the changing currents and temperatures of the air which moves over his

face. The blind person can follow a path through the woods by observing the slight changes in the pattern of sensations from the bottoms of his feet. All of these things the sighted person may do if he wishes and gives attention to those cues to which the perceptual associations have been established in the blind.

Many personality traits of the blind have been traced to their early difficulties in learning. There is a certain timidity or lack of initiative which has been often observed. The reasons for it are not far to seek. Inferiority feelings are common. And then there are peculiar habits known as blindisms from which the blind appear to receive no little satisfaction. Swaying of the body back and forth is one of them. If there is any of the slightest bit of vision, enough at least to distinguish slightly between light and dark, a satisfaction is found in waving the hand back and forth before the eyes. Egocentricity is also mentioned as a trait of the blind. Again reasons for it are not far to seek in a life which must be so burdened with the efforts to get on somehow, and in a world where there is the likelihood of an over-amount of petting, coddling and protection in general.

Where the blindness is only partial there are of course corresponding modifications of the above. Fragments of vision may be utilized and as a consequence the growing child may have only a modified amount of the differences just outlined. Where the loss of vision comes after several years perhaps of sighted living, then there may be useful recollections carried over, and there may have been established already many of the ordinary perceptions of life which can be used as a basis for the development of the necessary newer ones. If the loss of vision does not occur before the age of ten or twelve years, there will usually be no little carry-over from the years during which perceptions developed in a sighted world. Recollections of visual experience will remain, although if not used they are said to deteriorate but never to disappear entirely.

Color Blindness. Defects in color vision are quite common but complete color blindness, contrary to popular belief, is really very unusual. So far as we know these partial defects of vision occur more frequently among males than among females. Here again the reasons for the difference, if it exists,[2] are not known. These partial defects may appear in any one of many forms. Sometimes the person is color-weak; that is, at normal intensities colors may be recognized only with difficulty but at greater intensities the colors are distinguished quite normally. Sometimes there is a defective vision for certain colors but not for others. A very common form of this is the absence of vision for green and a certain rather purplish red. Apparently the person so defective has in the place of these colors merely the experience of a gray of some degree of intensity. Such a defect would also influence the perception of most other colors as they appear in everyday life. Any color in which this particular red or green is a part will not be seen as having the same quality as in the experience of the normally color-sighted person.

How these defects of color vision affect the course of individual human development is not very well known. One may suspect, however, that in their milder forms the effect may be very slight. But where there is a total absence of color vision, or even where there is the lack of vision for some specific color or colors, there must be a certain limitation to the range of experience. The person who has never experienced colors can know little of the beauties of the sunsets which so affect the normally sighted. When they talk of them he will not be able to understand much of what they say. The knowledge of his defect must have some effect upon what the individual thinks of himself. No one wants to be defective; rather does everyone seek to be as normal

[2] There is the possibility that no such difference between the sexes actually exists. It is contended by competent psychologists that if measures were available for all the many forms and degrees of color defect this alleged difference would disappear. See Dunlap, Knight, *Elements of Psychology*, pp. 109-111.

as possible. Hence the knowledge of being defective must make the individual think of himself as queer and different. That is unpleasant and may lead to inferiority troubles, peculiar attitudes toward himself, and doubtless peculiar attitudes toward others. Especially must this be true where embarrassing mistakes are made in the naming of colors, the selection of clothing, and the like. When these occur in childhood in the presence of other children, the consequences may be highly embarrassing and likewise unforgettable.

Deafness. This also appears in many degrees and forms. There may be a total absence of hearing; there may be merely a dullness of hearing over the entire range of sound pitches (commonly termed "hard of hearing"); there may be a limited range of hearing, that is, the individual may not be able to hear tones above or below a certain limited pitch range; and there may be fairly normal hearing over a fairly normal range except that there are gaps in it, places where the hearing is weak or nonexistent. Thus to class all of these together means the consideration together of persons whose sensory defects are so different as to make their life experience very different, perhaps even not properly comparable. Space here will permit mention only of the more serious forms of hearing defect.

The deaf and the very hard of hearing lack much of the experience which comes to those with normal hearing. They live in a soundless world. The language of sound which we so commonly use means little or nothing to them. Gradually they come to have some sort of understanding of our meanings, largely through the use of analogy, but for the completely deaf it must always be a defective knowledge. They are treated differently as a consequence; and this is contrary to the normal human desire to be well and like others. In the public schools they may be obliged to sit always in front seats; perhaps they are obliged to wear a special hearing apparatus (which is socially looked upon as much more queer and abnormal than the wearing of glasses); and

even then they miss much of what others catch so easily. Other children take advantage of the defect and talk of and about them in their presence. This leads to suspiciousness, which often becomes a well-established trait. One sees this also where deafness appears in persons of mature years. They are very likely to become suspicious because of their inability to sense certainly what is going on about them. The deaf are frequently said to have bad tempers, to become angry easily. This trait is probably an outcome of the suspiciousness engendered by their inability to hear, and perhaps the inferiority complexes growing out of their being treated as different.

Intelligence tests and tests of educational progress indicate that the deaf and hard of hearing are slower in development. *This is certain proof of the inference that the lack of hearing* limits the range of perceptual experience. If the child so handicapped is struggling to develop and to learn in schools for those with normal hearing, the ordinary public schools, the inevitable consequence of the slower progress is that he will soon become an over-aged child for the class or grade in which he is working. This will soon become evident to himself and to his associates, be embarrassing, and lead to anything but a normal social adjustment.

A further source of trouble comes in the difficulty of learning to speak. Years ago it was common to think of the "deaf and dumb" as though these were a combination of defects. Now it is well known that the difficulty of speaking, or inability to speak, is ordinarily the consequence of the inability to hear.[9] If one never hears speech sounds there is no possibility of imitating them with control through hearing. And where the hearing is defective the speech is likely also to be defective because the person so handicapped does not hear the sounds which others make perfectly, does not hear his own efforts correctly, and therefore, but poorly approximates

[9] The deaf may of course in some cases suffer also anatomical defects of the speech apparatus.

the normal speech of his associates. In almost any community examples will be found of children who have never learned to speak properly because of this influence of defective hearing. The less of hearing there is, the more difficulty there is in learning to speak. This also adds much to the problem of social adjustment, as well as to delay progress in the acquisition of knowledge.

Because of this difficulty the deaf are prone to a greater reliance upon gestures as a means of communication. In fact, as almost all readers must know, a very elaborate gesture language has been developed. The efficiency of this gesture language is often amazing to the hearing person who knows nothing of it. Its general structure as a language, however, is different from that of the English we use. For this reason, and also because few but the deaf know it, many students of the problem believe that its use should be suppressed. In recent years much progress has been made in the teaching of the deaf to speak and to read the lip movements of others. Where a high degree of skill in such speech and lip-reading can be achieved, it obviously makes the handicapped person much better fitted to live in the world of the hearing. But for many the achievement of any high degree of skill in this is apparently impossible. They thus tend to rely upon their gesture language and to limit their associations largely to persons of their own kind. This raises many problems concerning the education of the deaf and the very hard of hearing about which there is much difference of opinion even among experts.

Such training in speech and in lip-reading involves some very interesting problems in the psychology of perception. Obviously in the development of such speech habits much more emphasis must be laid upon kinesthetic cues and also upon cutaneous cues than is true of those with normal hearing. They must touch the voice apparatus of others, watch their breathing and lip placement, and so on, and then seek to imitate as closely as possible. In lip-reading meaningful

associations must be established with the sight of different patterns of the lips, of lip movements, of facial expressions and their various combinations. Some do develop a very high degree of skill in this, but many find it slow going. It will be observed also that the deaf make more use in their perceptual responses of other cues, such as vibrations coming to them through the floor or ground, than is common among those with normal hearing.

Refraction Defects in Vision. These are of such frequent occurrence that few escape entirely. They have been much studied, and a high degree of skill has been achieved in the adjustment or fitting of glasses for their correction. Where the correction is made early and the glasses are worn regularly the growth experience of the person with a refraction defect is apparently not much different from that of the child with normal eyes. But unfortunately there are many children with such defects where the proper glasses are not supplied. These do grow for a considerable period with the influences of the defect, whatever they may be.

Of these refractive errors there are many kinds and degrees. There may be a defective shape of the cornea resulting in clear vision in limited portions of the visual field only. This defect is known as astigmatism. There may be defects in the shape of the eyeball resulting in an imperfect clarity of vision. These are known as far-sightedness (hypermetropia) and near-sightedness (myopia). In both of these there is a blurred vision for most of the time. The child in school with myopia may not be able to see the front of the room clearly. The teacher and the items on the blackboard may be just a big blur. Where such is the case complaint may be made and something done about it; but there are instances of milder visual defect where the child cannot perceive details on the blackboard and does not complain because of the supposition that the same is true for all the other children. That such visual defects force an effort to see, and consequently eye-strain must be obvious, although

many sometimes make the mistake of supposing that there is no eye-strain where there is far-sightedness—a very serious error. We probably know very little of what the world of experience is like to the child allowed or forced to grow up with myopia uncorrected. We who have normal vision either by nature or by skilled correction can little imagine what it must be to live in a world of constantly blurred vision. That such should result in delayed educational development one can easily believe.

Other Sensory Defects. Other forms of sensory defect are many but no one of them occurs with sufficient frequency to justify detailed consideration in such a general survey as this. There are occasionally congenital cataracts, sometimes the muscles of the eyeball have disproportionate tensions resulting in the child appearing "cross-eyed," and there are defects due to troubles in the sensory nerve caused by disease. All of these disturb vision in one way or another, and thus to some extent the growth experience approximates one or another of the forms mentioned above. But such fields of study must be reserved for special consideration in courses or books about clinical psychology.[4]

Left-handedness. The world of human making is obviously designed for right-handed people. The person who is unfortunate enough to be otherwise faces many difficulties and much embarrassment. The inkwell on the school room desk is placed for the convenience of the right-handed. The lecture room chairs are built for the right-handed. Only in exceptional cases are desks and lecture room chairs supplied for the convenience of the left-handed. Tools which involve handedness are designed for the right-handed. Golf clubs, it is true, are available for others but they are the exception. Thus, being left-handed is a rather serious handicap. Progress may be delayed in the acquisition of manual skills and there may even be associated troubles as well.

[4] Louttit, C. M., *Clinical Psychology*, New York, Harper, 1936. See especially chap. XIV.

It seems probable that the handedness tendencies of infants, if a sufficient number are studied, are widely distributed. Some are destined by nature to be right-handed, some left-handed, and some can be as easily developed one way as the other or they may be developed into the ready use of either hand (ambidexterity). If it were not for the strong right-handed environmental influence, there would probably be far more ambidextrous persons than we now have. If it were not for the strong social pressure to be right-handed we should probably have many more left-handed people than we now do.

The specific cause of left-handedness has been much discussed and somewhat studied. It seems probable now that it is impossible to discover any one cause which has functioned in every case of left-handedness. Some may be due to the chance of early training. Perhaps they were carried in infancy in such a manner as to keep the right hand and arm confined; thus giving the left hand and arm more activity and consequent advantage in development. Some may be due to some influence before birth, possibly of intrinsic determination, which tends to a physiological emphasis of control from one side of the brain more than the other.

It is known that the left hemisphere of the brain is connected primarily and directly with the right half of the body and the right hemisphere of the brain with the left half of the body. Many now think that in right-handed persons the left hemisphere of the brain is dominant. That should of course appear in other features than mere hand preference. This is true and is designated as the *laterality* of the person. Laterality varies greatly from individual to individual. Some are right eyed, right handed, right footed and use the right hand dominantly in bimanual activities. Others are as completely the reverse, presumably having the other hemisphere of the brain dominant. Left-handedness would in such cases be associated with other evidences of left sidedness. And this is usually true. It is also true that some children are

easily retrained into right-handedness and some resist every effort to retrain. Probably those who can be readily retrained are fundamentally right sided and those who so persistently resist retraining are fundamentally left sided. It is now considered good practice not to force a child to use the right hand if a little effort in that direction does not bring prompt results. This on the assumption that the above theories of laterality and intrinsic determination are correct.

Very young infants appear to use either hand without preference but it is generally reported that hand preference in grasping appears at about the end of the first year of growth. It is not thus comparable to traits that are ready to function at birth. It is rather a trait which appears as the product of maturation.

Systematic studies of the feelings and attitudes and troubles of persons who are left-handed are not available. But common observation of the behavior of children quickly reveals that certain left-handed children are definitely handicapped thereby. Other children are prone to make fun of them, and this affects both the feelings and the concept of the self. If forced to try to change to right-handed writing, for example, the result appears ludicrous to other children, is slow and laborious and time wasting to the person so forced. Poor grades in school may be a consequence. But the effort to change over from left- to right-handedness may be fraught with more serious consequences still. There has long been the belief that speech disturbances were sometimes the consequence. It is true that certain studies have failed to reveal speech troubles in those who have been forced to make such a change; but it seems equally true that there are instances where such a change has caused speech disturbance. Whether this is a direct cause or whether the speech trouble started in the emotional disturbance associated with embarrassment over poor manual skill is an open question. Perhaps in individual instances both are effective. Certainly

the danger of such speech troubles appearing is now considered far less than formerly. Even, however, if no applied speech problem appears, it remains a problem which is more serious, to go through the struggle of changing over to right-handedness or to go through life with the persistent problem of living left-handedly in a right-handed world.[6]

Speech Defects. Learning to get on in the world, the development of perceptions and conceptions, the growth of thinking—all involve the use of speech in human beings. A defect of speech may seriously disturb and delay this progress. That there are many speech defects everyone knows very well, and everyone can discover by a little observation that these speech defects are far from being all alike. In some there is an anatomical defect which prevents the normal formation of speech sounds. The cleft palate is a good example of this. Sometimes the acquisition of speech is considerably delayed. Often, although not always, this is associated with feeblemindedness. In rare cases a brain injury, perhaps at birth, may be the cause of the imperfect speech. Sometimes the imperfections of speech can be attributed to the environment. The child growing up in a home where some foreign language is ordinarily used, and when English is spoken it is badly pronounced, is almost certain to acquire wrong habits of pronunciation and also of diction which may be a source of trouble for a long time. Yet other causes of poor speech will be found in tongue-tied conditions, hare-lip, nasal obstructions and a bad alignment of teeth. All of these function to make enunciation wrong or difficult. But by far the most common form of speech trouble is that known as stuttering.

Specialists in this field are accustomed to classify many

[6] On this subject the following references are excellent especially because each includes many references to other literature:

Louttit, C. M., *Clinical Psychology*, New York, Harper, 1936, pp. 442-443.

Murchison, C. (Ed.), *A Handbook of Child Psychology*, Worcester, Clark University Press, 1931, pp. 34, 178-179, 258-259.

different forms of stuttering [a] but for our purposes here they may be treated as a single form or group of speech disturbances. That the child who stutters possesses a serious handicap to development everyone can recognize. Such a child can read and observe and think, but the normal mode of social intercourse is largely blocked or made so difficult as to make the child avoid it as much as possible. Frequently such children develop to a serious degree that trait of personality known as introversion. They find their satisfaction inside themselves. They prefer to read and to think rather than to make the effort to converse. They are prone to think of themselves as defective and inferior with all the emotional disturbance and variations of behavior associated with such ideas. The difficulty of speech quite securely blocks their most natural means of self-expression.

The causes of stuttering are now generally believed to be fundamentally functional, that is, there is for them no organic defect or degeneration. The habits for speaking are to some extent imperfect. There is in them a lack of the perfect co-ordination necessary. For example, in one form of stuttering instead of taking in a breath as the child begins to speak all air is suddenly expelled from the lungs. In such a condition the child can of course not utter a word. Many other inco-ordinations have been observed in the vast pattern habits of function involved in speech. And, then, along with these disturbances within the speech pattern itself many peculiar extra or additional habits develop around the speech difficulty. Something in such cases must have happened when the speech pattern was young to start the serious malformation of these habits. And following that original emotional episode many others associated with it have served to distort the speech pattern still further. Re-education of

[a] Fletcher, J. M., *The Problem of Stuttering*, New York, Longmans, 1928, chap. II.
Stinchfield, S. M., *Speech Disorders*, New York, Harcourt, Brace, 1933, chap. II.
Travis, L. E., *Speech Pathology*, New York, Appleton, 1931, chap. II.

such cases is possible, but it is a long and difficult task because the habits have usually become so well established by the time anything systematic is done for them.

Doubtless many cases of stuttering are associated with the nature and degree of laterality of function described above in the discussion of handedness. Speech involves muscles on each side of the median plane of the body. That means that in speech there must be an especially nice co-ordination. In stuttering there is evidently a disturbance of this co-ordination and it is more than likely that there is a lack of complete control or dominance by one hemisphere of the cerebrum. In such cases there appears to be a functional conflict between the two sides of the brain. Travis [7] has done a vast amount of experimental work on this phase of the problem and has demonstrated that certain stutterers can be greatly improved by forcing the development of more perfect laterality of functioning at the same time that the retraining of the speech habits is under way.

The Inferiority Concept. This is a form of handicap to normal development which is closely associated with all that has gone before. It is a concept and, like all other concepts, it grows out of perceptual experience and the meditation over such experience. It is essentially a concept of the self which involves the meaning that the individual is less competent, less able, less fortunate, than others or even defective in some fashion. To the individual it means that he or she can never achieve the things most desired in life and can never achieve much against the competition of other persons of the same age but who are believed to have had greater advantages.

That such a concept should have many associations with feelings and emotions is easy to understand. When the person who thinks of himself as inferior wants to excel, he is practically certain to be disturbed emotionally. And, furthermore, such a person is far less likely to try and to try

[7] *Op. cit.*

hard. For such a person it is much easier to give up with the I-can't attitude. It means also that he will rarely be well-adjusted socially. He may want to show achievement in some direction but because of this concept have the belief that he cannot do so. The result is often the development also of certain associated traits which hinder him still more. The person may develop what is known as a *defense mechanism*. This is a form of activity which will protect feelings. There may be the habit of appearing hard-boiled and superior as a device to keep people from saying personal things which might stir feelings of unpleasantness. Watchful observation will reveal many other traits to be actually forms of defense mechanism. But it is not always easy to be certain if any specific trait is certainly a defense mechanism or not. When, as Shakespeare says, "the lady doth protest too much" one may suspect such a mechanism of defense, but one can rarely be sure that his suspicion correctly represents the facts in the case.

Such inferiority concepts often appear in children who suffer physical or even functional defects. The crippled child, the child who stutters, and so on, are prone to such concepts. But they are far from being confined to childhood. They are especially active in the years of adolescence (the "teen" age). Competition in high school for social recognition is keen, especially in the larger schools. The little fellow, the homely girl, those who have not had assisting social advantages, those who have not had the help of a useful home training—all these are prone to develop concepts of inferiority[6] with their attendant feelings and emotions and the consequences in behavior. The freshman in college is prone to such inferiority beliefs, and the sophomores ordinarily do nothing to prevent their development. The pathetic feature of such concepts is the possibility of their leading the individual who possesses them to give up and not try to achieve. Frequently, however, the inferiority

[6] Inferiority *complexes* are mentioned below.

notion has been a stimulus to great achievement. The I-will-show-them-I-can-do-it attitude stirred by the inferiority concept has been the motivation for many great achievements in this world. Many men and women now in positions of distinction and great responsibility got their start through such motivation.[9]

Attitudes. The attitudes which a child develops toward his family, toward his teachers, towards his playmates, etc., may be a serious handicap to his development or they may be of very great assistance. The general psychology of attitudes has been already presented in a preceding chapter. Here it is necessary only to observe how an attitude may be a serious handicap in development.

Examples of such interference by attitudes may be readily found. If, for example, a child had established in himself a decidedly negative attitude toward school and teachers and all that concerned study, then it would be obviously very difficult to educate that child in the ordinary way. Suppose, further, that this very negative attitude were but a reflection of the attitude of his parents; then even forcing the child to go to school would not be of much value because the little the school could do would be in large part canceled by the negative attitude, and that attitude would be continually reinforced at home. Suppose, as the consequence of some highly emotional experience with a particular teacher, a child develops a very negative attitude toward that teacher. Then obviously it will be at least doubly hard for that teacher to have much influence over that child. Children often for reasons not well known acquire very negative attitudes toward particular school subjects, particularly teachers, certain neighbor children, and so on, which seriously hamper their social development. These negative attitudes tend to make life unhappy for the child and to raise problems for both parents and school authorities. Some persons unfortunately carry these very negative attitudes with them

[9] Vaughan, W. F., *The Lure of Superiority*, New York, Holt, 1928.

into maturity. They are then said to be temperamentally unco-operative and difficult. They are socially difficult because of this negativity. On the other hand, attitudes of acceptance and co-operation are attitudes which aid greatly in the progressive socialization of any child. That they should have an inquiring attitude is also desirable, but this is just one of the positive attitudes which helps in the development from childhood to an understanding maturity.

Conflicts in Response. People frequently comment upon the grace, ease and perfect economy of effort manifest when a cat jumps from the floor into a chair. There is just enough effort and just the right movement to bring the cat onto the chair seat and no more. Ideally such is the way all human responses should be made, but unfortunately most human responses are not so perfectly and economically performed, and many of them are made in a highly uneconomical and imperfect manner. Often we find that where many responses are simultaneously stimulated instead of their appearing in a manner to assist in making one perfect focalized response some of them are opposed to each other. When for example one is faced by the necessity of crossing a street where there is considerable traffic, it is necessary to move smoothly and promptly and with a nice co-ordination of all muscular activity. But it can be easily observed that all persons do not so move across a street. Some dodge forward and back, hesitate, jump about, look this way and that, and appear in general to be in a state of bewilderment.

That very term "bewilderment," or confusion, implies the presence of tendencies to do many different things, most of which are opposed to or inconsistent with the others. The term "conflict" is properly applied to such behavior, wherein there are two or more opposed tendencies. One cannot do both, so the consequence is that one does neither, starts to do first one and then the other, or does something quite different from either as a desperate means of getting out of the distressing situation. A good example of this may be

seen in the child who wants to go to see the visitor but also seeks to remain near the mother. There is a dodging back and forth, false starts that are inhibited by returns to the mother, resulting at last perhaps in the child suddenly darting out of the room entirely.

Conflicts in behavior are unfortunately not confined to childhood. They appear prominently in adolescent years and some persons never entirely outgrow them. The behavior of many adults, the general traits of personality of many adults, can be readily explained in terms of the persistence of conflicts or of habits which have grown out of the effort to solve such conflicts. There is a very normal desire in most persons from infancy up for recognition. This is ordinarily satisfied in school days by the various kinds of rewards and prizes for good work done and by the habits of the family in recounting to visitors the achievements and clever sayings of the child. In adolescent years there is the satisfaction of this desire for recognition through election to clubs and societies, the election to offices and committees and so on of many kinds. Diplomas and graduation exercises and personal mentions in the newspapers, the winning of athletic awards and honors provide very normal satisfactions of this desire. In later youth and early maturity the attention and expressions of approval by persons of the other sex please because they satisfy this desire for recognition. Advances in salary and promotions in rank still further contribute to this satisfaction. But it is important to recognize that many persons seek such recognition and fail, or believe they fail, to receive it. The trouble may lie in opposing or conflicting impulses within themselves.

An example of this can be found in the experience of the famous English novelist, Charlotte Brontë. She sought recognition, as do all persons, but she believed that she was so homely in personal appearance that people were repelled by her ugliness. Thus the impulses to approach and to seek were inhibited by the belief that she was not wanted and the

associated impulse to withdraw. In this instance there was no just cause for the belief and, therefore, no justification for the conflict and the unhappiness which it caused. But there are instances where conflicts are more justifiable, in fact sometimes conflicts are socially desirable. One may, for example, have an impulse to run across a lawn, perhaps even start to do so. Then one sees a sign warning to keep off the grass and on the corner a policeman watching. These physical circumstances stir a conflicting impulse to walk around on the sidewalk, although one may still be in a hurry and really want to run across the lawn. The consequence may be the walking around on the walk but the emotion aroused by the conflict may find vent in some hot words, perhaps stamping with the feet, maybe clenching of the fists, and perhaps an excessively courteous greeting to the policeman as one passes the corner. With children, and at times even with some adults, the impulse to run across the forbidden area may dominate in spite of the conflicting impulses aroused by the perception of the law. Doubtless these two examples will serve to call to the reader's mind many other illustrations of behavior related to conflicting impulses. Usually they make one unhappy and sometimes very uncomfortable.

The Complex. Sometimes one of the impulses of a conflict is motivated largely by what is known as a *complex*. This term has been so much used in popular literature in recent years that it has come to have a familiarity for most people, but frequently persons who use the term are not very clear as to its exact meaning. The concept of the complex must then be carefully thought over before it can be wisely used in connection with this matter of conflicts in behavior. Strictly speaking a complex is never known except indirectly through its effects. We are never aware of a complex as we are aware of a perception or an idea or a feeling. The complex is essentially a theoretical conception developed for the explanation of certain otherwise unexplainable forms of be-

havior. When for example a person experiences fear with all of its attending impulses but without any apparent reason for the fear, it is necessary to assume that there was something within the individual which brought about this fear reaction. If two persons are in precisely the same physical situation and one of them experiences a violent fear without being able to say what it was which aroused the fear, it seems proper to assume that there was something functioning in one of these persons which was not present in the other. It is this something which is termed the complex. In one person the physical situation aroused merely the familar responses we have described as perceptual. In the other there was the same perception but also the fear, although the person experiencing the fear reports that he can see no reason at all for the fear reaction. Thus when the emotional reaction is out of place, inappropriate, or far too intense for the nature of the situation it has become customary to think that the particular situation must have aroused not only the perception but also some additional pattern which in turn aroused the emotional response. It is this additional pattern, for the existence of which there appears to be ample evidence, that is termed a complex.

One may for example ask a man very mildly concerning his political affiliations and stir an intense and effusive response concerning a certain party. Between the stimulus and the response there must be a pattern, established through much experience, which stirs the intense and voluble reaction. Then we subsequently learn that this person has been an active member of this particular political party for many years. It could thus be said that he has a certain kind of political complex. Certainly there is as much reason here for assuming the existence of a complex as there was above in the case of the unexpected fear reaction. It is, however, now generally considered better practice to reserve the term "complex" for those determining patterns which produce reactions that disturb or prevent the happiness of

the individual concerned. Therefore, the fear case described above would be classed as due to a complex while the political partisan case would ordinarily not be so described. Complexes are supposed to produce reactions which break up or prevent normal and comfortable social adjustment.

The Inferiority Complex. A good example of a complex so conceived is that which is commonly spoken of as the *inferiority complex*. Behavior attributable to this complex appears frequently in children and young people, also not infrequently in some adults. But it must be observed that all feeling of inferiority is not to be attributed to the presence of an inferiority complex, any more than are all fear responses to be attributed to a fear complex. In the presence of a great work of art, a great work of nature such as the Grand Canyon or Niagara Falls feelings of inferiority are quite natural and appropriate. It is when the feeling of inferiority appears too often, with too great intensity, and upon occasions when it seems inappropriate, that we assume the existence of an inferiority complex. There is thus to be observed a *difference between a feeling of inferiority* and *an inferiority complex*. The concept of inferiority has already been discussed, but one should recall here that in certain circumstances one may think of himself as inferior without any disturbing effects, perhaps even without any feeling of inferiority. A very ordinary tennis player, one who nevertheless gets much pleasure from the game and the exercise it provides, may in the presence of a champion think of himself as a very inferior tennis player. It stirs no feeling of inferiority and no distress. It is just the recognition of a matter of fact. It is merely a concept of inferiority concerning the self in certain relations.

The inferiority complex, however, when it does become established, is to be classed as one of the most serious handicaps to social adjustment and personal achievement. Its functioning is apparently simple. Situations which should not arouse much feeling of inferiority arouse it intensely;

and this feeling of inferiority is all too frequently stirred by little things which should not arouse it. Then this recurrent feeling of inferiority stirs impulses to withdraw and to avoid. These impulses conflict with the normal efforts to be and to achieve social recognition. Thus too much conflict is aroused within the personality and there is too much unhappiness and erratic behavior. Such a complex is ordinarily brought into being through many experiences of inferiority, actual or assumed. But it appears also to be possible that an inferiority complex may be the product of one vividly intense and dramatic experience. Some great disappointment or some highly tactless remark on the part of some respected adult may be enough to start a complex.

Good and Bad Conflicts. It must not be concluded, however, that all conflicts in behavior are bad. Far from it. Only some of them are. When one starts to say something and then realizes that it would be wiser not to make that remark the impulse is inhibited. That is a case of conflict obviously. But it is also as obviously a socially desirable form of conflict. We would be in a sad way indeed were it not for this ability to inhibit reactions before they have become overt and complete. Frequently we start to do things and then become aware, on second thought as we say, that such conduct is not courteous or wise and as a consequence the tendency to action is inhibited. Only by such conflict can self-control become established. Much of the discipline of children in the home is designed to establish conflicts which will make decent conduct more likely to prevail.

Conflicts are bad only when the opposed or checked impulse is so strong or so recurrently aroused as to become a cause of trouble. Sometimes, often in fact, the opposed or checked impulse is provided means of satisfaction or expression at some other time, and in some fashion which will do no harm. When, for example, we are made very angry and are disposed to express ourselves fully and freely at the miscreant person himself, we find that we are inhibited by

thoughts of propriety, wisdom, future needs and the like. We then go to some friend and "blow off" where we know that no harm will be done. It is known that some persons under such circumstances relieve their feelings in the privacy of their own room or office. Substitute modes of satisfaction are often discovered for the satisfaction of the conflict inhibited impulse. At some other time and in some quite different manner the impulse may be satisfied. The person whose drive for the feeling of power or achievement is blocked, later on finds satisfaction in doing something quite different, but in doing it so much better than someone else that there is aroused the glow of achievement and satisfaction of the drive.

Results of Conflicts in Behavior. Some recognized forms of behavior caused by the presence of conflicts within the personality deserve special mention. In small children a *tantrum*, or violent expression of temper, is a form of conduct caused by conflict. Something is desired and the desire is opposed by rules or regulations or the presence of mother or nurse or someone. The result is the violent emotional outburst. The same behavior is sometimes, although fortunately far less often, to be observed in the behavior of adults. There are persons who never entirely outgrow childish ways of behaving.

It is interesting to observe in adults and later adolescents what is technically termed *regression*. One may occasionally observe the dignified, ordinarily poised, business man in an argument find it impossible to convince his opponent, to make him "listen to reason" as he says. The features of a psychological conflict are immediately observable. The desire to convince the other man is blocked by the perceptions of obtuseness or stubbornness in the other. Then, with failure in sight, the man suffering the conflict resorts to childish ways of behaving. This is regression. He is seen and heard to talk louder and louder, to gesticulate ever more wildly, and probably in the end resort to the childish trick of calling

names (profanity). This is a good example of the slip backward down the genetic scale to older ways of behavior when the conflict can be solved in no other apparent way. It is this return to old ways of behavior that is termed *regression*.

Conflicts not infrequently lie behind delinquent behavior. Stealing by boys and girls is frequently a good example, although it must not be thought that all stealing is so motivated. There is the desire to excel, to overcome, blocked by parental and other restrictions or lack of opportunity. The thrill of achievement is denied. The result is much impulsive, erratic activity, as an expression of the desire to excel. Successful stealing offers a ready means of winning over others, of getting a thrill of achievement, and it is a means of achievement far too frequently resorted to by children whose desires are blocked. Proof of this interpretation of such delinquency can be found in the many instances where the stealing disappears promptly when some activity is provided which supplies satisfaction for the normal desire to achieve and to get a thrill. That there are other causes for delinquency no one can doubt, but careful analysis will often reveal that where other causes are at first accepted a conflict may be found at the bottom of the trouble.

Projection is still another form of behavior growing out of conflicting impulses. A good example of this is when a person stumbles over a chair and then kicks the chair as though the chair were itself somehow to blame for the accident. Actually the easy forward progress of a certain form of activity has been blocked by the chair, but the real fault lies within the person who stumbled over the chair. He has been clumsy enough in his haste to fail to observe exactly where the chair stood and just how to move in order to avoid it. The impulse to forward progress has been actually blocked then by the clumsiness of the individual himself. The person who should have been kicked is the individual who stumbled. But it is human to dislike admission that one is at fault, hence the fault is projected onto the chair.

Other examples of such projection may easily be discovered. The boy who has struck another boy may when caught and accused of his fault loudly assert that a certain other boy "told him to do it." This is a lie of course but the psychologist observes that the form of the lie is due to a projection. It is disagreeable to admit that the self is at fault and so the impulse is blamed upon another person.

Rationalization is likewise a common form of activity motivated by a conflict and may at times take on the appearance of a defense mechanism. Essentially, rationalization is the construction or acceptation of some principle according to which some prior action of the person involved will appear to be commendable when under ordinary circumstances it would result in a blameworthy state. The boy who neglects his lessons seriously and as a consequence receives a failing grade at the end of the term is prone to rationalize his failure. It is disagreeable to admit that the fault is his. He seeks approval like all human beings, especially the approval of his parents. The desire for approval and the admission of negligence appear to be in conflict and decidedly to his own disadvantage. Then he develops the notion that the teacher is really a very incompetent teacher and that perhaps his own failure is not his fault but attributable to the incompetency of the teaching. A failure due to poor teaching is far less disagreeable than a failure due to one's own negligence. Therefore, as long as he can convince himself of the incompetence of the teacher he feels a little better about it. Moral delinquencies and failures to live up to long-accepted social obligations are often so rationalized. Some people find much relief and comfort in just such rationalizations until someone, courteously or not, succeeds in puncturing them.

A personal weakness, inability, or defect may be rationalized and thus some of the disagreeable consequences avoided, but the better and healthier way is to develop a *compensation*. The child who does not do well in school

frequently compensates for his deficiency by superior achievements on the playground. And, likewise, the child who does not do well on the playground may find compensating achievement in the work of the school room. It is sometimes contended that many great scholars became such through the early effort to compensate for the inability to achieve in physical activities. The blind, the deaf, and persons otherwise crippled are famous for their development of compensating skills. Compensation differs from defense in that there is involved no effort to conceal or avoid. There is a frank admission of the inability and an effort equally frank to develop some form of achievement which will compensate.

Maladjustment as Handicap. The child or the adult in whom there are seriously conflicting tendencies to action is very likely to become what is known as a maladjusted individual. The person who has a bad temper because of an inferiority complex is not likely to have many friends or to be elected to offices or to receive in any form as much recognition as most human beings desire. Such a person is said to be maladjusted. But the person in whom responses are well co-ordinated, who knows what to do in every situation and does it with ease and grace, is usually admired and made welcome everywhere. Such a person is said to be well-adjusted. The development of happy social relations is a phase of all normal development. Where this is missing, where there is maladjustment in some form, there is an inevitable handicap to development.

In the foregoing paragraphs many causes of maladjustment have been discussed. The child who suffers a sensory defect has his social difficulties and hence is often maladjusted. Left-handedness, speech defects and disturbances, social attitudes which interfere with growth and happiness, conflicts, projections, rationalizations and all the rest are both causes and consequences of maladjustment. It must be obvious that a child who suffers any of these will have diffi-

culty with his associates, with his school work, with his teachers, and so on. The result may be a greatly uneven development. He may grow in physique, in intelligence and in knowledge but in social relations may easily remain essentially a child. Such instances are not at all uncommon. Fortunately they are now better understood. The awkward and the difficult child is properly no longer thought of as innately queer but as the victim of some circumstances which militate against achievement. Many school systems employ experts who study these special cases and on the basis of their analyses coach the teachers, the parents, the children themselves, and all others concerned and are thus often able to relieve the difficulties.

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Chapter XIV

FATIGUE, SLEEP, DRUGS

One of the most troublesome disturbers of human efficiency is fatigue. It is a common experience. Most people know what it is to be tired. And most people suppose that the study of fatigue is a relatively simple matter. But it has not proved to be such. Even the definition of fatigue has been difficult and it has proved to be a peculiarly difficult item to subject to measurement. That there are two aspects of fatigue to be considered everyone who studies the subject recognizes. There is the loss of functional capacity as the consequence of actual work done. This is conceived physiologically as the consumption of energy-producing compounds stored in the nerve cells. For the restoration of those compounds prolonged rest and sleep is necessary. There is also another aspect of fatigue. That is the effect of the presence in the body of the products of metabolism, fatigue products as they are sometimes called. These are partially known. There is carbon dioxide, lactic acid and probably other things. These probably produce the fatigue sensations with which all are familiar. It is the effect of these which can be canceled by some drugs but their removal and the restoration of the energy-producing substances are not produced by taking a little caffein or other drug. These can be removed and the others restored only by rest and normal sleep.

Ordinarily we now think of fatigue as the reduction of the capacity for function through the actual effects of activity. The ratio between the two is not simple and direct. At least so far as we know it is not. There may be no apparent re-

duction of capacity after considerable activity. And there may appear to be considerable reduction of capacity after very little activity. Why this should all be is not clear. And why it should be so difficult to measure fatigue is also not quite clear. But the facts are as they have been stated. Of some of the effects of fatigue upon other functions we do know a little and to these it is necessary to give the most of our attention.

Attention Effects of Fatigue. Fatigue produces characteristic sensations. These are distracting and thus disturb continued attention. The student who has lost sleep and is very tired complains of his inability to keep his mind on his work. His attention wanders when it should be upon the task in hand. He may be painfully aware of his tired condition or it may be just that his thoughts wander to other things.

This change may be described in terms of the kind of attention evident. The higher or derived forms of attention disappear under fatigue and there is a return to the older or simpler forms of attention. From the derived forms the person tends to slip back to voluntary attention in which there is effort. This of course is no help because to maintain attention by this effortful method is all the more fatiguing. When this, too, is worn down by fatigue the person will find himself slipping back to the spontaneous attention of childhood. He can then apply himself steadily to nothing. His thoughts wander hither and yon over anything and everything but to nothing for any length of time.

Memory Effects of Fatigue. A tired mind does not learn readily. This is now well established and is an important observation. Impressionability appears to be reduced with fatigue. Persons who have climbed high mountains frequently fail to recall anything that they saw from the top. They were so tired from the effort of the climb that they were unable to attend effectively to what they saw after they reached the top. Hence their inability to recall. Students

who have sat up all night in preparation for an examination often find that in the later hours of the night the material they go over does not have much effect. They are too tired to be impressionable or to attend well.

So far as we know, recall is also seriously affected by fatigue. When one is fatigued the tendency is to recall silly and unimportant things. Associations which come to mind in a fatigued state tend to be meaningless and thus useless. Evidence of this appears in the experience of most persons. When very tired, students find it next to impossible to recall in the examination room items which they could ordinarily recall very well. They can only think of silly and unimportant things when they want to think of items of importance.

Recognition, a very important part of the memory experience, may not appear at all, as a consequence of fatigue. Instances are reported of persons who were able to recognize the nature of items about them of houses, and streets, street cars and the like but were quite unable to recognize the names of streets, a very important item in knowing where one is. Thus such persons would find themselves totally lost in places where they were actually quite at home. Perhaps this happens in a very mild way in ordinary experiences of fatigue. What is recalled may not be recognized as of importance and so not followed up because of the fatigue.

Inhibitions Weakened by Fatigue. The development of inhibitions has already been indicated as one of the important features of growing up. The infant has none, the child few, the adolescent has achieved many, but in the adult there is normally much control by them. One effect of fatigue is to weaken these inhibitions. That means, of course, that a fatigued person is much more likely to act impulsively, to do things which he may subsequently regret. The fatigued child is much more irritable and difficult to manage. The fatigued youth, while normally responsible enough for a youth, will be much more likely to do the impulsive and erratic thing. Extreme fatigue is likely to con-

tribute to, if not actually produce, hysterical states. Hysteria is primarily control by emotion when normal inhibitions are either weak or weakened by some cause. Fatigue may frequently be the cause; and hysterical attacks the result. The common form of "hysterics" in which some emotions break loose from normal control occurs usually in a state of fatigue. The once famous cases of shell-shock, which appeared with such distressing frequency during the World War, were in large part due to the great fatigue produced by the kind of life the soldiers were forced to lead. Rest was thus a large factor in their recovery.

Fatigue and Reaction Time. The average length of an individual's reaction time is increased; and the reaction time is also made more variable by fatigue. These facts harmonize very well with the rest that is known of fatigue. They also point to the generally reduced capacity for function of the tired nervous system.

Fatigue and Accidents. Related to many of the foregoing items is the fact that a fatigued person is much more prone to accidents of all kinds. His attention is not as perfect and steady; and his reactions are not as prompt. Associations are poor and so the judgment is not as good. Industries have found that workers are more prone to accidents toward the end of a work period. Interestingly enough the frequency of accidents does not rise steadily from the beginning to the end of a work period. They rise to a peak toward the end and then the frequency falls off quite rapidly. Probably this is because there is less work done during the latter part of a work period, and so there is less opportunity for the accidents to take place. If the workers were pressed to work as steadily right to the end this curve of accidents would probably rise continuously. Automobile accidents are doubtless also often due to fatigue. That momentary falling asleep is the cause of many accidents has been much publicized, but there is also the possibility that

a fatigued driver may not act as promptly nor with as good judgment in an emergency as would a rested driver.

Pauses and Work. Much attention has been given to the effect of rest pauses upon work efficiency. It has been found for example that a worker who rests for a few minutes with regular frequency does more than the same worker steadily or with less frequent rest periods. A brief period of intensive work, depending upon the nature of the work done, and then a short pause, when the efficiency of the worker is beginning to decline a little, results in much greater production.

In studying lessons, this principle may be applied but with certain considerations. It is true that one can study most effectively if there are occasional stops for rest. But the rest should not come as frequently as in some manual activity which produces boredom more easily than does study. Indeed one of the most valuable features of a rest period is the elimination of boredom and its effects. There is also a feature known as swing or habituation. When one first starts to study one may have been occupied with other things which do not drop away at once and so the work starts a little uncongenially and a little awkwardly. Students who have attempted to write a theme by sitting down and going directly to work upon it know this experience very well. But after a little application the extraneous thoughts drop away, the work goes better and better. This is known as swing or habituation. A rest pause should not be brought in so soon as to break the effect of this swing. And, it may be added, a rest pause should never be so long as to remove the possibility of getting back into swing very quickly when the work is resumed. The pause, however, seems to contribute much toward the postponement of the disturbance by fatigue.

Signs of Fatigue. These are all curiously quite unreliable. As a matter of fact, there is no good indication of how ready we are to work. Many a person has found that his own feelings are a very poor indication of his actual capacity

for effort. He may have little inclination to work and believe that he is too fatigued to accomplish much. But if in such a state he forces himself to attack the job he often finds that he is soon in the swing and doing very well indeed. Feeling tired is thus no certain indication of the presence of fatigue. Probably the only way to be sure is to try the work and find out. Experimental tests have been made upon this topic with the same results—that the feelings are no safe indication of what one is capable of doing.

Confusion with Monotony and Boredom. The actual effects of fatigue, irritability, restlessness, the disinclination to continue, and so on, are well known to all students. But these are easily confused with the effects of monotony and the loss of interest. When any work is lacking in interest for the worker and becomes monotonous there is the disinclination to continue unless there is some ulterior motivation. But ordinarily monotony is a common cause of what appears to be fatigue. So too with boredom. Some have thought that boredom was more important than fatigue. Because, when boredom is removed by the development of some special interest, it has been found that the person was apparently just as capable of work as before. Certainly boredom is to be given careful consideration. Probably in the life of the student the occasional rest period is chiefly valuable for its removal of boredom. Just what boredom is we do not know so well. But certainly it produces a condition not easily distinguishable from fatigue. The person who has sat through a very boresome lecture may feel very tired when it is over, although he has paid very little attention and done no more work than to maintain himself in the chair.

The Nature of Sleep. Sleep is the natural way for removing the effects of work and fatigue. It is an experience so common that one may be surprised that our knowledge about it is no greater than it is. Up to very recently we had far more theory than fact concerning what was actually taking place in the body while a person slept. But, fortunately,

recent years have seen a revival of interest in its study with the result that there are many things about sleep now very well established. Two things certainly take place during the sleep period. One is the restoration in the nerve cells of the unstable compounds necessary for activity. Another is the removal from the vicinity of the nerve cells of the products of activity, of those substances which cause the consciousness of fatigue. Thus a proper period of sleep in which the normal restorative processes are working normally should leave the individual as ready to work again as he was originally.

Effectiveness of Sleep. The full restoration of functional capacity mentioned in the preceding paragraph depends of course upon many things. It depends upon the length of the period. But how long a period is necessary, how much sleep each individual needs, cannot be stated definitely because we are quite certain that in this feature there are very large individual differences. The amount of sleep which will completely restore one person is not enough for another.

It is obvious also that the amount must vary with age. The infant sleeps a very large part of the twenty-four hours of a day. As wakefulness increases, as activity increases, less and less sleep appears to be necessary. Perhaps the recuperative processes improve also with the years, and perhaps the waking activity does not make such serious demands in the later years as in infancy, but in any case not so much sleep is necessary as the person approaches maturity. There is danger here, however, in assuming that this change goes on indefinitely. Many young people make the mistake of believing that they need much less sleep than they actually require.

The effectiveness of sleep depends also upon the quality of the sleep. Both the quantity and the quality are important. The person may sleep eight hours, which should probably be adequate for the adult, and yet because of the nature of the sleep find himself not much refreshed by it. The

troubled wakeful sleep of the worried person does not produce the recuperation necessary for the day's activity. These differences between a good sound sleep and a disturbed sleep are familiar to everyone. It needs merely to be stressed that the effectiveness of the sleep is to be related to the quality as well as the quantity. A troubled person coming to the psychologist for consultation may state that he has a sufficient number of hours of sleep. Obviously the consultant must consider the quality of it also.

"Depth of Sleep." The notion that sleep varied in depth was long current. Just where it arose no one today seems to know, but it was long accepted in the best of scientific circles. It was supposed that sleep was a general condition into which one might pass to a greater or less degree. This degree of the state was designated as the depth of sleep.

It was supposed that the depth of the sleep could be measured by the strength of any stimulus necessary to arouse. It did not appear to matter much which sensory threshold was used. The auditory and the cutaneous pain thresholds were commonly used because of their convenience. If a person did not wake when a strong sound was made then it was reasoned that such a person was in a very deep sleep. If a slight sound awakened them they were supposed to be in a shallow sleep. By such methods of study a curve was obtained for the course of a normal sleep period. According to this the sleeper fell rapidly into a very deep sleep, the greatest depth being achieved somewhere in the second hour of the sleep period. After that the sleep grew steadily more and more shallow until the waking point was reached. This was accepted everywhere as the normal curve of sleep.

Gradually the realization spread that this was probably not to be thought of as a curve of the depth of sleep. People came to question the old concept that sleep was a general condition into which a person passed in a greater or lesser degree and which could be measured by any sensory disturbance. The old studies of the depth of sleep were reviewed

and found to be very defective. This led to the need of a better concept and of better methods for the experimental study of sleep. The result was the development of a method for the study of sleep by the measurement of the amount of movement made during sleep. Special apparatus was devised for attachment to the bed upon which a sleeper lay by which every movement could be automatically recorded.

The result of these studies of degree of quiescence during sleep are now accepted as much better because they do not rest upon some conception of the nature of sleep, but present directly the actual behavior of a person while asleep. These studies show, however, that the amount of movement declines after the person goes to sleep to some place in the second hour and then the number of movements increases with a gradual rise up to the point of waking. That this is practically identical with the old measures of the depth of sleep by sensory disturbance is obvious, but it does not imply that the depth of sleep has been measured. The claim is merely that the amount of sleep or degree of quiescence has been recorded.

It is further important to observe that the amount of movement for the average sleeper is considerable. Normal healthy sleepers make from 20 to 45 movements in the course of a night, and most of these are fairly large movements involving the general position of the sleeper. Apparently these movements are associated with the circulation of blood and the general condition of the tissues in those areas which are pressing against the bed. They seem also associated with the emotional state of the sleeper. It has been found that the sleep of children may be altered significantly by the experience of seeing a moving picture show in the evening before. These movements can also be affected by fatigue and drugs. They seem to be significant indicators of the condition of the sleeper whether tired, or drugged, or emotionally excited, or what.

Disturbances of Sleep. Parents early learn that the very tired child and the very excited child does not sleep well. Peace of mind and general quietude is necessary to good sleep. If a person is overly fatigued that condition may even prevent his going to sleep easily. And if a person is emotionally aroused, frightened or very angry, he does not go to sleep easily for the obvious reason that the sympathetic division of the autonomic system is activated instead of the parasympathetic.

Unfamiliar patterns of stimuli are also a common cause of poor sleep. The person who is habituated to going to sleep in a bed which produces a certain familiar pattern of pressures may not be able to go to sleep readily when he attempts to sleep in a bed which produces a very different pattern of pressures. A familiar pattern of noises outside may have no effect upon the sleeper accustomed to them but may have a very disturbing effect upon one who is accustomed to a different pattern of sound stimulation. Sleep may of course also be disturbed by bodily pains and other disturbing physical states.

Effects of Loss of Sleep. Prolonged loss of sleep produces effects which have been very carefully studied. But these experimental studies of great loss of sleep are merely the exaggeration of those effects which most people have observed in themselves or others when very tired. There is the familiar irritability, and a notable disinclination to work. Attention is poor. It wanders from one thing to another no matter how much the person may wish to keep it steady. In some extreme cases of loss of sleep there are reports of hallucinations.

The experimental studies have largely failed for a reason which has no little practical significance. The method has been to subject the person to a number of tests before the sleep fast begins and then to retest him after the sleep fast had ended and before the person is permitted to go to his much-needed rest. The results of such work, however, have

largely failed to reveal significant effects of the loss of sleep, although the person who applies the tests may observe in the subjects the very effects of sleep mentioned. Apparently the reason why the tests fail is because the subject of the experiment can for the brief period of the test exert sufficient effort to compensate for the effects of the loss of sleep. This appears often in everyday life. We may see a person who appears to be much too tired to keep further engagements brace up and carry on in an amazingly effective manner.

For practical purposes it is important to observe also that the effects of the loss of sleep are probably cumulative. A normal period of sleep should restore the person to a fully rested condition. But if the period of sleep is too short or too poor to do this, then the person starts the next day below his maximum. If another night fails to restore him, then another day is begun still further below normal. As this goes on it is easy to observe that very great fatigue may eventually be the consequence.

Learning and Sleep. Sleep is now known to have an interesting effect upon learning. The fading out of an impression is considerably slowed by a period of sleep. In other words if a person is memorizing something, the intervention of a period of sleep does not result in the same amount of loss as would a comparable period of wakefulness. This does not mean that one is learning while he sleeps but rather that he is not forgetting so fast while he sleeps.

Popular notions about the solution of problems in one's sleep must be largely discounted. There is no evidence for the belief that mathematical problems can be solved better while asleep. When such claims are carefully studied one finds that the person who claims to have solved the problem in his sleep has actually solved the problem upon waking. The night before he probably got into a rut and worked always in a wrong direction. Sleep removed the set toward these bad habits and made possible a fresh attack upon the problem in the morning and the achievement of the solution.

Alcohol. Whatever one may think about the propriety of the use of alcohol as a beverage, all must admit that its total effect is that of a depressant. There is much popular misconception of this. But so much experimental work is now available for evidence that no one can seriously contest the depressant nature of the effects of drinking alcohol. There has been some indication that a first effect of small doses might be slightly stimulating to mental processes but all studies indicate that this soon disappears and that the effect of larger doses is always depressant. This applies of course to the central nervous system and it is with that that the psychologist is first interested when he considers the body of the human being. Other effects, appearing as a consequence of the weakening of inhibitions, may be the reason why people have been misled into thinking that alcohol is a stimulant.[1]

The course of normal intoxication by alcohol reveals the depressant influences. One of the first effects is a disturbance of the control of attention. The mind wanders rapidly from one thing to another. Such a person soon tells all his secrets, or many things that he would normally keep to himself. This exemplifies the weakening of inhibition. Then, as the control still further weakens, the emotions are no longer subject to the same inhibition. The consequence is that the intoxicated person becomes easily made tearful and sympathetic to an effusive and unpleasant degree. Anger is likewise easily aroused. The speech becoming thick indicates the loss of control of the higher co-ordinations. The course of intoxication is progressive and downward toward the older and lower functions. Eventually the person loses control of his skeletal muscles and is unable to walk steadily or may even so completely lose control as to be unable to walk at all. This depressant effect of alcohol upon the higher mental function may also be observed in the nature of the emotional responses. There is early a dulling of the finer or nicer feel-

[1] Emerson, Haven (Ed.), *Alcohol and Man*, New York, Macmillan, 1932.

ings. The person becomes more and more rude and vulgar. Eventually only the most primitive emotions appear.

Why the Use of Alcohol? Many have asked this question, especially upon discovering that the flavor of an alcoholic drink is ordinarily not pleasant. One probable cause is the search for that feeling of well-being which every normal person desires to have. As the higher mental processes are deadened by alcohol there comes to the individual a sort of feeling of well-being, or euphoria, which to many is a welcome relief. That this is misleading can be readily demonstrated. Many suppose that they can think better at such times or that some latent powers are released. But experimental studies all point to this being a complete illusion. Perhaps alcohol is used in order to achieve this false sense of well-being.

A little alcohol, by weakening inhibitions, makes people less sensitive and so more genial, happy, and gay. Many a party is apparently livened-up considerably by a few drinks. Under the effect of alcohol the diners forget their cares and troubles and responsibilities and become more sociable. By the same means genuine anxieties may be forgotten or escaped. It is probable that many an alcoholic person drinks to escape his troubles. He drowns his sorrows in a flood of alcohol which deadens him to his situation in life. Young people also sometimes begin drinking under the false impression that it is smart, or being like grown-ups, to do so. But whatever the motivation, the effects are always the same. And the after-effects are just as disagreeable, coming as they do with the realization that perhaps in the intoxicated state something has been done for which they will be greatly ashamed.

Relation to Personality Integration. One of the well-established facts about alcoholic effects is that they vary with age and the degree of personality organization. The well-integrated adult resists the effects of alcohol far better than does the poorly integrated. Thus one often finds that

chronic alcoholism is based upon an abnormal personality. Such are by nature far less able to control and so they yield to the temptation more readily.

It will be recalled that there are not only large individual differences among adults in this matter of personality organization but that individuals vary in this degree of organization as they vary in age. The child has little organization and control, the youth much by comparison but by comparison with the well-organized adult is still immature and likely to be impulsive. So it should be clear why the effects of alcohol are greater upon children and youth than upon well-organized adults. They are also in the reverse of the normal direction of growth. Growing-up means becoming better and better organized so that the stimulating events of life do not disturb so easily. The use of alcohol is thus in exactly the opposite direction. The chronic use of alcohol means a chronic delay in the development of integration and control.

Relation to Fatigue and Excitement. It was pointed out above that a fatigued person has a poorer control than one who is fully rested. Fatigue thus has an effect similar to that of alcohol. This explains some otherwise puzzling instances of alcohol effects. Not infrequently one will meet a person who has had a little alcohol but is assured that the person cannot possibly be intoxicated because he has had so little. The amount that has been imbibed may actually be not enough to produce intoxication in the ordinary person of that age. But if one finds that the person had been very tired before taking the alcoholic drink one may then understand why the unexpected and unusual effects. The fatigue had already prepared the person for loss of cerebral control and the alcohol taken was sufficient to complete the loss. Doubtless neither the fatigue nor the alcohol alone would have had so great an effect.

Emotional excitement, it has been pointed out above, is also fatiguing because of the constant effort to keep the emotions within bounds. Both work and emotional excitement

thus combine to weaken control. Then when this is supplemented by alcohol the job is quite complete. This may often be seen when tired individuals decide that they need recreation. They are already inclined to forget and to act impulsively. They add to this some alcohol and they are quickly intoxicated to a point where they are likely to do almost anything. Their ideals and inhibitions are now too weakened by the combined effects of fatigue and alcohol to have much influence.

Caffein. The common use of this drug, which is the active principle in tea and coffee and certain soda-fountain drinks, makes a detailed knowledge of its effects highly desirable. Unfortunately, however, although it has been much studied, the results of the studies are not so certain and unequivocal as in the case of alcohol. Some studies appear to indicate an improvement under its influence of certain higher mental processes. Work is reported to be more efficiently done; test scores are better; the person is more clearly awake; and the reflex time is shorter. But other studies quite as reliably done give quite different results. The subjects are reported to do poorer work, to have lengthened reaction times, to have lost in accuracy, to be unable to concentrate as well. Inhibitions are said to be weakened and there is the appearance of headaches and dizziness. So just what to accept from these is not clear.

Of one thing we may be certain and that is that there are large, very large, individual differences in the effects of caffein. Some persons are very sensitive to it and show clearly its effects; other persons are quite hardened to it and show its effects but slightly if at all. There is some indication that larger doses are more likely to be depressant in their effects than are smaller doses, but even this is subject to the influence of individual differences.

Where caffein does deaden the sense of fatigue, and it is often used for that purpose, it should be clearly understood that the caffein has not restored the functional capacity of

the person using it. The fatigue only has been removed. Thus nature's warning that rest is needed has been silenced. The person is permitted to continue to work when in need of rest, to fatigue himself still more. And this may be dangerous. Students frequently when confronted by a stressful examination situation, for which they should have prepared long before, are prone to use caffein as a means of keeping themselves at work and awake. When this is done it should be kept in mind that the ultimate consequences are a still greater fatigue, or exhaustion of the substances necessary to activity, and thus a proportionately greater amount of rest is necessary for complete restoration.[2]

Tobacco. Concerning the effects of tobacco upon the personality and work of human beings, much that is unreliable has been written and published. Prejudice has here entered in more than in the consideration of any other drug, with the possible exception of alcohol. We have been told that smoking produced poor scholarship in school. But for most of these alleged effects of tobacco there is no reliable evidence.

Of experimental studies there have been many but only a few which have been done by methods which can be trusted. Experimental work with smoking has been especially difficult because of the problem of developing a method for control. Just how to have a group of experimental subjects who thought that they had smoked and had actually not smoked for comparison with the work of subjects who had been subjected to the effects of smoking was the problem.

[2] The literature on caffein effects has never been well digested and brought together for general reading. For references one should see the following:

Conklin, Edmund S., *Principles of Abnormal Psychology*, p. 442.

Hull, C. L., "The Influence of Caffeine and Other Factors on Certain Phenomena of Rote Learning," *Journal of General Psychology*, 1935, 13, 249-274.

Miller, N. E., and Miles, W. R., "Effect of Caffeine on the Running Speed of Hungry, Satiated and Frustrated Rats," *Journal of Comparative Psychology*, 1935, 20, 397-412.

Switzer, St. Clair A., "The Effect of Caffeine on Experimental Extinction of Conditioned Reactions," *Journal of General Psychology*, 1935, 12, 78-93.

Eventually this was solved [8] and now we know some things about the effects of tobacco with confidence in the reliability of the observations. We know certainly that smoking does disturb eye-hand co-ordinations. One becomes trembly and inaccurate as a consequence of smoking tobacco. Nice co-ordinations are disturbed. On the truly mental effects we are not so certain. There is some indication of slight effects on perception, memory and learning but the effects, if reliable, are very slight and thus of little importance.

Many studies have been made of the relationship between school grades and smoking. It has been demonstrated more than once that lower grades are associated with the habit of smoking. But it cannot be safely concluded from this that the smoking caused the poor grades. Students of high mental ability and high scholastic records smoke; so do students of poor ability and poor records. The truth appears to be that smoking and low grades are associated but not causally. Loafers are more likely to smoke and loafers are more likely to have poor school records. The industrious student may have ideals which prevent smoking and the industrious student may be very serious about his work, serious also about the expenditure of money, and so for economical reasons does not smoke. The industrious student also does not have the time for loafing and the development of the habits associated with loafing. In the same fashion does smoking become associated with delinquency.

Much misunderstanding has arisen from the established fact that many able minds can do their best creative work while smoking. That this is true even the most earnest opponent of smoking must admit, but it does not force the conclusion that the excellent work is attributable to some mental effect of the smoking. It is probable that the smoking is simply a part of the pattern of stimuli to which the successful worker has become conditioned. The smoking

[8] Hull, C. L., "The Influence of Tobacco Smoking in Mental Efficiency," *Psychological Monographs*, 1924, 33, no. 3, 1-160.

is thus in the same class as the familiar desk, the familiar chair, the familiar litter on the desk, and so on, all are features to which the workman has become habituated, conditioned, so that without them he is uncomfortable and unable to work well. He is unable to work well without his familiar desk and chair. He is also unable to work well without his pipe or cigarette. They do not cause his mind to work well. But unless they are present he finds himself irritated and uncomfortable, and thus does not work well. With his pipe and desk and litter and so on he is comfortable, he is at home, and he works well.

Marihuana. This is the drug which above all others is at present causing alarm. That it should cause alarm is proper because the effects of using the drug are bad. But the danger of addiction is not great. Young people, especially, because of their desire for something new and for a thrill, are reported to be using it in increasing quantities. In all probability this is an interest which will pass, but in the meantime its effects should be known and understood.

The drug is most commonly used in this country in the form of a cigarette popularly known as a "reefer." Sometimes the drug is referred to as "Mary Warner" and by other slang terms more or less related to its right name. The drug is well known as cannabis. It is obtained from a plant known as hemp and in the Orient has long been known as hashish.

Some of its effects are especially interesting to the psychologist. Perceptions of space and time are much altered. Time seems to be much prolonged. Space perceptions may be altered either way. There may be false perceptions of vast size or of normal things appearing as diminutive in nature. One case reports himself as feeling, while under the effects of the drug, as being very small—so small that he sank to the bottom of a glass of water into which he fell. Socially and personally the danger from the smoking of marihuana lies in its release of inhibitions, especially those which control the basic drives and impulses of life. It certainly releases

control of the sex urge and possibly stimulates it. Impulses to attack other persons are likewise released. The result is that serious crimes may be committed under its influence. At first the drug is said to produce mild anxieties and vague fears, this soon passes into a period of exceptional activity and restlessness, after that comes a delightful euphoria in which ideas are flighty and the person is very talkative and elated. This is the phase in which offenses may be committed. In some cases there are visual hallucinations. After a couple of hours, drowsiness comes on and then sleep from which the person awakes with no after-effects.

In its complete release of inhibitions lies the great danger from the use of this drug. And, if it is a sexual excitant as well, there lies all the more danger. Under such a drug youth may do what he would never think of doing in his normal state; he may do that which will leave with him a lifelong regret. The drug may leave no lasting damage, but that which is done under the effect of marihuana may leave the person permanently in prison or with a memory too horrible for eradication.[4]

REFERENCES FOR FURTHER STUDY

Dill, D. B., Edwards, H. T., and Forbes, W. H., "Tobacco Smoking in Relation to Blood Sugar, Blood Lactic Acid and Metabolism," *American Journal of Physiology,* 1934, 109, 118-122.

Drewry, P. H., "Some Psychiatric Aspects of Marihuana Intoxication," *Psychiatric Quarterly,* 1936, 10, 232-242.

Emerson, Haven (Ed.), *Alcohol and Man,* New York, Macmillan, 1932.

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[4] The following papers give excellent descriptions of the effects of the drug, with case descriptions:

Bromberg, W., "Marihuana Intoxication, A Clinical Study of Cannabis Sativa Intoxication," *American Journal of Psychiatry,* 1934, 91, 303-330.

Drewry, P. H., "Some Psychiatric Aspects of Marihuana Intoxication," *Psychiatric Quarterly,* 1936, 10, 232-242.

Reznick, S. P., "Marihuana Addiction," *Social Work Technique,* 1937, 2, 172-177.

ness of attention; quickness or alertness in response, quickness of perception of relations.

The foregoing are aspects of intelligent behavior which function in the perception of relations, in the solving of problems, and in making adjustments to new situations. They are not entities or arbitrary forces; they are, rather, descriptive statements of the forms in which mental ability manifests itself.

Even after determining what forms of behavior shall be tested, there still remains the problem of selecting the actual materials, or problems, or items, which shall really and efficiently sample these selected aspects of intelligence. To do that, current measures of intelligence use tests of arithmetical reasoning, sentence completion, naming word opposites, matching proverbs, completing analogies, understanding difficult passages, detecting absurdities, memory span for words and digits, a variety of vocabularly tests, picture completion, information, verbal problems, and a variety of situations in which the young child deals with objects rather than with words and numbers. In some of the tests, time limits are set, thus introducing the factor of quickness of response, or speed.

We shall have occasion, shortly, to return to the materials of the tests themselves, giving actual examples of the items employed. Before doing so, however, we ought to consider briefly the developments which resulted in producing the mental tests as we know them today.

Development of Mental Tests. In their earliest efforts to measure mental ability, dating approximately from 1890, psychologists employed relatively simple tests of sensory and motor capacities, the hope and perhaps the assumption being that individual differences in the sensory perceptions and in motor responses were significantly correlated with known manifestations of intelligence. If this had proved to be the case, psychologists would now be in a very fortunate situation as regards the measurement of intelligence. For then it

would have been necessary only to devise tests of vision, hearing, quickness and accuracy of motor response, etc.—a relatively simple and direct matter. Unfortunately, however, the simple sensory and motor tests proved valueless in the problem of intelligence testing.

Some examples of these unsuccessful measures are tests of keenness of eyesight, color vision, and hearing; perception of pitch and time; perception of weight; sensitivity to pain; strength of grip; rate and accuracy of hand movement; and speed of reaction to a simple stimulus. But researches using these measures contributed little to an understanding of the higher and more complex mental processes called intelligence.[1] Subsequently it was shown that what we regard as intelligence has very little correlation indeed with the simple behavior demanded by the foregoing tests.

Little progress was made with the problem until about 1900 when Alfred Binet, a French psychologist, and his collaborators objected to the simple sensory and motor tests then being experimented with. Binet maintained that the complex and higher mental processes should be tested; for it is in these that individual differences are most marked; and it is in these that individuals are distinguished most significantly and characteristically from one another in their daily activity. Consequently, Binet and Henri (a collaborator) proposed to study the following functions: memory, mental images, imagination, attention, comprehension, suggestibility, esthetic feeling or appreciation, moral sentiments, motor skill, muscular strength, strength of will, and visual judgment.

With these views in mind Binet and his collaborators devised the first test, published in 1905. This was revised in 1908, and again in 1911. In addition to Binet's earlier insistence upon getting at complex mental processes rather than

[1] For an historical survey, see Peterson, Joseph, *Early Conceptions and Tests of Intelligence*, Yonkers, N. Y., World Book, 1926. For a brief survey, see Young, K., "The History of Mental Testing," *Pedagogical Seminary*, vol. 31, 1924, 1-48.

the simple sensory and motor, the revisions incorporated several important principles in mental testing. These were: first, the items of the test shall be arranged and graded in a "scale" of increasing difficulty according to chronological age levels; and, second, the items shall be varied so as to include the greatest number of mental functions. He also contributed the concept of mental age (see p. 469), so significant and widely used today.

Binet's 1911 mental test was revised and adapted for use in the United States, the scale being completed in 1915 and made available for use in 1916. This test, known as the Stanford Revision of the Binet-Simon Test, has been very widely used throughout the United States. It does not, however, add any essentially new concepts to those of Binet. Nevertheless, the Stanford revision, in addition to being translated for use in this country, was more accurate, since it was better standardized than the original.[2]

After twenty-one years of widespread and valuable application in schools and clinics, the Stanford edition appeared in revised form in 1937. This new form is known as The Revised Stanford-Binet Scale. The authors of the test state that its superiority to the 1915 form is due to the fact that it has been extended at both extremes, thus covering a wider range of capacity, and that it has been standardized upon larger and more representative groups.[3] Here again, this test does not add any fundamentally new principles of mental testing; it is an improved instrument for measuring intelligence according to the principles enunciated by Alfred Binet.

The original Binet scale and all the revisions which have followed are *individual* tests; that is, they can be used with only one subject at a time. The length of time required for an examination varies with the age, brightness, and re-

[2] See Terman, L. M., *The Measurement of Intelligence*, Boston, Houghton Mifflin, 1916.

Simon was one of Binet's collaborators.

[3] Terman, L. M., and Merrill, M. A., *Measuring Intelligence*, Boston, Houghton Mifflin, 1937.

sponsiveness of the individual. Consequently, to test a large number of individuals would be costly in time, and in some situations impossible. Obviously, therefore, if a very large number of individuals were to be dealt with, as in the schools, a test which could be applied to many subjects at the same time would be advantageous in time, effort, and cost. Psychologists, in fact, were already working on the possibility of devising *group* tests; and they continued their efforts for some years. As a result, there are today numerous group tests of mental ability—some being very reliable and highly valid—designed for use at different educational levels, from the kindergarten to the university.[4]

Shortly after their appearance, the Binet and the group tests were criticized because of their verbal character. It was maintained that mental abilities should be tested by means other than those of words and numbers. It would be wrong, the critics argued, to assume that a test using symbols (language and number) altogether will be an adequate measure of the intelligence of one whose proficiency is greatest in dealing with things rather than with symbols. Accordingly, "performance tests" have been devised,[5] providing a situation to be dealt with by *manipulating* or *doing* something rather than thinking something with symbols. These performance tests have been particularly valuable in studying children handicapped by language difficulties, or by serious visual and auditory defects. However, one criticism often heard against this type of test is that it does not examine the higher mental processes as adequately as do the verbal scales. Still, there can be no doubt that this type of instrument is in some cases a valuable supplement to the verbal test, at times revealing an aspect of mentality not shown by the latter.

Specimens of Test Materials: Infancy and Early Childhood. The definitions and theories of intelligence have al-

[4] For specimens, see Pintner, R., *Intelligence Testing*, New York, Holt, 1931, chaps. 6 and 7.

[5] See Pintner, R., *op. cit.*, pp. 159 ff.

ready been presented. We have indicated, also, the particular kinds of manifestations that psychologists believe should be sampled by means of a mental test. And we have named a few of the actual types of materials employed, such as arithmetical problems and sentence completion. In the present section, we shall be concerned not only with giving some actual specimens of items from a few well standardized tests, but we shall see that the items are intended to reflect the mental growth and changes that take place with an individual's increasing maturity. The items, as we go up the chronological age scale, are of increasing complexity, require integration of a greater number of elements within the framework of a given problem, require solutions which are less direct and therefore more difficult, become less concrete, etc. The tests measure, among other things, growth of perceptions and concepts.

We begin with materials employed with infants, starting at the age of one month. The items presented are not complete for each age level; they are selected merly for illustrative purposes.*

One month: Lifts head from time to time when held to the shoulder; turns head laterally when in prone position; gives definite heed to sound; has differential cries for discomfort, pain, and hunger; stares at a window or at massive objects; gives transient visual regard to a red ring; retains definite hold of the ring when it is placed in the hand; shows selective regard for faces.

Three Months: Holds head erect and steady when held to shoulder; smiles responsively to social approach; gives vocal expression to feelings of pleasure; eyes follow moving pencil; head turns freely in inspection; shows anticipatory excitement; opens mouth expectantly in feeding; fingers one hand with the other in tactile motor play.

Six months: Sits momentarily without support, if placed in a favorable leaning position; grasps with simultaneous flexion of fingers; vocalizes several well-defined syllables; expresses recog-

* The following items through the level of thirty months are from Gesell, A., *Infancy and Human Growth*, New York, Macmillan, 1928. By permission.

nition of familiars; reaches for object on sight; discriminates between strangers and familiars.

Twelve months: Walks with help; holds crayon adaptively to make stroke; has a vocabulary of two "words"; adjusts to simple verbal commissions; adjusts round block to form board or rod to holes; uses string adaptively to pull ring; holds cup to drink from; inhibits simple acts on command.

Twenty-four months: Runs; piles tower of six blocks with good co-ordination; imitates vertical or horizontal strokes; names three of five objects; uses words in combination; places blocks in row to make train; adapts to reversal of form board; places cube in cup, plate, or box; tells experiences; explains pictures.

Thirty months: Goes up and down stairs alone; piles seven or eight blocks with co-ordination; tries to stand on one foot; names five pictures; attempts to build bridge from model; marks twice for cross; gives full name; helps mother put away things.

Many of the forms of behavior indicated in the foregoing do not conform to common conceptions of intelligence. Nor do some of them resemble the materials employed to test older individuals. But the items as a whole constitute a developmental scale of motor development, language, adaptive behavior, and personal-social behavior. These are held by many psychologists to be significant evidences of a child's stage of development at the moment of examination as well as symptomatic of his later level or degree of mental development.

Several important general conclusions emerge from the "norms of behavior" given above. They reveal, first, the expected rates of neuromuscular development and sensory development. This is shown by the greater, more precise, and more adjustive control and activity of the head, eyes, hand, fingers, and other body parts. Second, the norms show the child's increasing awareness of the environment. That is, the environment, at first a relatively undifferentiated background, gradually assumes new meanings, new significance for the child as he matures. People, objects, events, differences in sounds (for example, quality of voice and words), visual differences (for example, facial expression, pictures,

and strange people), which previously were unheeded and presumably unperceived, are now attended to and evoke differentiated and more appropriate behaviors. This is the process of *differentiation* which is achieved by maturation and learning, through which the individual is enabled to gain control over his bodily movements, and by means of which he acquires knowledge of the world in which he lives.

By this process of differentiation the individual's motor behavior (lifting the head, sitting, standing, walking, grasping, etc.) proceeds from the crude, inept forms of early infancy to, for example, the expert pianist's perfect control of each finger. The same process is evident in the individual's progressive development whereby a relatively "blurred" or "fused"—undifferentiated—environment evolves into one rich in details and meanings. In fact, it is one function of education to promote this process of differentiation, thereby enabling the individual to make more adequate—more intelligent—adjustments to more kinds of situations and to provide more appropriate solutions to problems.

Specimens of Test Materials: Childhood to Adulthood. The following samples, taken from the Revised Stanford-Binet Scale (1937), illustrate the types of materials used for individuals from the age of five to adulthood.[7]

Five years: Completes drawing of man (one leg and both arms missing); folds sheet of paper into triangle; defines *ball, hat,* and *stove;* copies square; repeats sentence (ten words) from memory after hearing it once; counts four objects.

Seven years: Detects absurdities in pictures; discerns similarities between two things (such as *wood* and *coal*); copies a diamond; comprehends a relatively simple verbal problem and supplies answer (e.g., "What's the thing for you to do when you are on your way to school and notice that you are in danger of being late?"); gives opposite analogies (e.g., "Brother is a boy; sister is a . . . ."); repeats five digits after hearing them once.

[7] See Terman, L. M., and Merrill, M. A., *op. cit.* Used by permission of and special arrangement with the publishers, Houghton Mifflin Co.

Ten years: Is able to define a group of words, concrete nouns for the most part (such as orange, gown, eyelash); detects absurdity in a picture (much more subtle than in year seven); reads a short passage and reproduces the materials of the passage; finds two reasons for a given statement (e.g., "Give two reasons why most people would rather have an automobile than a bicycle"); names as many words as possible in one minute; repeats six digits after hearing them once.

Twelve years: Defines a group of words (going somewhat beyond those in year ten, such as *lecture* and *skill*); detects absurdities in several statements; interprets a picture representing a somewhat complex situation; repeats five digits *backwards;* defines abstract words (e.g., *courage, charity*); fills in one missing word in each of four sentences, the omitted word in each case being a connecting word (such as *because, since*).

Average adult: Defines a group of words (going beyond and becoming more difficult than those in year twelve, such as *peculiarity* and *priceless*); figures out the scheme of a code and writes several words in it; gives differences between abstract words (e.g., *laziness* and *idleness*); solves rather simple arithmetical problems without use of pencil or paper; interprets proverbs.

Most superior adult: Defines a group of words (continuation of earlier group, becoming much more difficult, such as *flaunt, ochre, mosaic*); without use of pencil and paper, solves "orientation" problem involving directions and distances; gives opposite analogies (e.g., "*The pine tree is evergreen; the poplar is* . . .); draws pattern showing appearance of sheet of paper that has been folded in complicated manner and cut; solves a "reasoning" problem in which the principle must be discovered; repeats nine digits after hearing them once.

Inspection of the actual problems and items employed in the foregoing reveals the following facts, consistent with the definitions of intelligence and with the means whereby it should be measured, as previously set down in our discussion.

1. Word definitions are common to practically all levels: the number of words to be defined increases, proceeding from the more common and concrete to the less common and abstract. For example, the words chosen for the five-year level are names of common objects which Terman and

Merrill say "belong to the everyday experience of five-year-old children." The words at the level of the superior adult, being more abstract in character and representing less common objects will presumably be selective of the better intellects, for the assumptions, generally correct, are that more intelligent persons will have had wider and more penetrating experiences; that they are able to deal with concepts requiring the use of abstract words; and that they will be able to analyze new words on the basis of words previously learned, thus being better able to define them. The words progress in an orderly fashion from the easier to the more difficult.

2. By means of series of digits and meaningful sentences memory span is tested, the materials to be repeated increasing in length with the rises in age levels. But the meaningful materials, in some instances, involve more than sheer retention; for they require not verbatim recall but the reporting of concepts or meanings derived from the prose passage. In addition, visual retention is tested by means of the paper-cutting tests which are employed at various levels and with increasing complexity from the fifth year through the superior adult level.

3. "Appreciation of spatial relationships and the ability to make use of visual perception to guide a rather complex set of motor co-ordinations" is tested by having the subject copy a square, a diamond, and other visual patterns. Difficulties encountered and methods employed by the subjects, especially younger ones, indicate that the forms to be copied are perceived as units, or wholes, and not merely as a group or series of lines. This again illustrates the point that was made before: namely, that earlier perceptions are relatively undifferentiated.

4. The capacity to solve problems, by means of choosing alternatives, integrating the elements involved, perceiving relationships, likenesses, and differences, is tested with prob-

lems of increasing complexity and subtlety. These problems, though largely involving verbal comprehension, make use also of maze tracing, pictorial comparisons, and picture absurdities. In every instance, the subject must keep in mind the problem or situation as a whole, and he must be able to judge the elements, or parts, or questions in the light of that whole and of the particular end being sought. It is a sign of more intelligent behavior as the individual is able to incorporate the less obvious and a greater number of elements in the solution of a problem or in the achievement of an end. The less intelligent person can solve only the problems or situations involving fewer factors; and these factors must be more obviously and more directly related to the situation.

Though we have by no means gone into a detailed analysis of all the mental test items, we have nevertheless indicated enough to show that some essential *forms* of mental activity are being tested throughout practically the entire range of the scale, whether the materials employed are verbal or non-verbal in character. To be sure, the specific materials are not always of the same type at all levels; yet it will have been observed that in many instances the types are identical over a wide range. Principally, however, the forms of intelligence—or the mental functions—are being measured through increasing complexity and subtlety of the materials and situations, progressing from the highly concrete to abstract symbols.

Types of Items Used in Group Tests: Verbal. Although group tests are intended to measure the same mental processes as the Stanford-Binet individual test, their technique is different; and they therefore require different types of questions. Here we shall present merely some sample items to show their forms.[8]

Knowledge of word meanings is tested by means of *opposites* and *similars* as follow:

[8] For details, see Pintner, R., *op. cit.*, chap. 7.

Underline the word in parentheses which is the opposite of the first word:

accept.....(receive, percept, deny, reject, spend).
constant...(always, fickle, stationary, seldom, movable).

If the two words mean the same, write S on the dotted line between them; if they are different, write D.

hill......... valley
brief........ short

Underline "opposite" if the two words mean the opposite; and "same" if they mean the same.

furtive......	sly	same—opposite
superfluous..	essential	same—opposite

Analogies provide a test not only of word knowledge but also of the perception of relationships. Several examples follow:

Underline the best of the four words in parentheses:

cellar—attic:	bottom	(well, top, tub, house)
man—arm:	tree	(shrub, limb, flower, bark)

Underline the right word:

Coat is to wear as bread is to
eat...starve...water...cook
Cat is to tiger as dog is to
bark...wolf...bite...snap

Comprehension is measured by means of the *best reason* test, such as the following:

Check the best reason:

Gold is more costly than lead because
(1) it is of finer appearance.
(2) it is more scarce.
(3) it is used for jewelry.
(4) it is yellow.

Comprehension may also be measured by the use of *disarranged sentences* which, however, introduce the additional element of organization into a meaningful whole. Examples follow.

Underline "true" or "false" according to the meaning of the disarranged sentence:

will live bird no forever true . . . false

Cross out the superfluous word in the disarranged sentence:

watch summer the man stole is jail who the in

Perception and comprehension of relationships are tested by the *sentence completion* and *number completion* methods:

Write one word in each blank:

The boy —— two dollars to the Red Cross.

Fill in the missing numbers:

26 22 — 14 10 — 2

In addition to the preceding materials, the group tests employ such tasks as interpreting proverbs by matching them with statements which are explanatory; solving arithmetical problems; giving information by means of selecting the correct word (e.g., John Wesley was famous in literature, science, war, religion); making classifications which require logical or categorical selection.

Most group tests have much in common; but a number of them introduce variations in the particular manner in which a given factor shall be tested. Thus, as we have seen, there are several methods for testing word definition and perception of relationships. But so far as testing the factors of intelligence through their manifestations goes, most group tests do not differ from the Stanford-Binet, though the latter and several other individual tests are regarded as the more reliable. The group tests must differ in technique, however; for they must provide the subject with answers from which the correct choice is to be made; or they must present an item that can be answered by supplying only one word or element, as in the completion tests; whereas in the individual test, the question is put to the subject and the answer is recorded.

Types of Items Used in Group Tests: Non-Verbal. Group tests of intelligence, in addition to employing verbal materials such as those enumerated, use non-varbal problems which, in their solution, are designed to duplicate the forms of mental activity required by the verbal. In other words, the same factors presumably may be measured by means of both types of materials.

The following are some of the non-verbal types: the picture completion test, in which a missing part must be supplied: the maze test, requiring the tracing of the shortest path; picture absurdities test, in which the wrong or absurd part of the picture is to be indicated; copying geometric forms; numbering a series of pictures so that they form the proper sequence; selecting pictures on the basis of esthetic quality; selecting pictures that belong to a given category and rejecting the others; rearranging the parts of a picture to give it meaning. (Fig. 27.)

This list is not exhaustive; but it suffices to show how efforts are being made to get at manifestations of intelligence without complete dependence upon just one type of material.

Performance Tests. The original Binet scale and its several revisions in this and other countries are almost entirely verbal in character. The subject receives his directions orally; the problem or task is stated; and the reply or solution is given verbally, either orally or in writing. There are a few items which are exceptions in this respect, particularly in the earliest years of the 1937 Stanford-Binet; but for the greatest part these scales test intelligence through the subject's use of and facility with symbols—language and number.

The performance test,[8] on the other hand, requires the subject to deal with *concrete materials*, to manifest his abilities with objects rather than with language and concepts.

[8] For detailed descriptions of performance tests, see Garrett and Schneck, *op. cit.*, part 2, chap. 2.

Ordinarily the directions are given orally, either in whole or in part. Language understanding is, thus, not entirely eliminated; but it plays a very small rôle and, in fact, is often ac-

FIG. 27. The picture completion test of the Pintner non-language mental test. (From Rudolph Pintner, *Intelligence Testing*, Henry Holt and Company.)

companied by the examiner's motor demonstration. These performance tests are particularly useful with very young children, with children under a language handicap, and with the deaf. Furthermore, performance tests are useful as supplements to the verbal tests in the case of a child who is a so-

called "verbalist," and whose language facility gives him a spuriously high intelligence rating.

Many of the performance tests are of the "form-board" type. Pieces are cut out, and the subject is required to fit these together in their appropriate depressions in the board. The board and pieces vary in complexity of design, number of depressions, and possibilities of error. Scores are based upon the time or number of moves required to complete the task, or both. Figure 28 shows some samples of form-boards as well as several other types.

Another type, also shown in Figure 28 on page 468, is the picture completion test. Interestingly colored pictures are fixed upon a board; sections of the picture, in blocks or other shapes, are removed; these the subject must fit into their proper places to complete the picture. There are several variations of this, such as the "manikin test," consisting of six wooden pieces which, when fitted together properly, will form the body of a man; and the "feature profile test," consisting of eight pieces which fitted together correctly form a human face.

Qualitative Differences in Intelligence. As we shall see, the mental tests such as those described yield, in most cases, numerical scores which are converted into "mental ages," these in turn being converted into "intelligence quotients." (See pp. 475 ff.) Although a few, like the Stanford-Binet, do not yield numerical scores, their results also are given in terms of mental age and intelligence quotient. One question that has been raised is this: are increases in scores, mental ages, and intelligence quotients indicative only of a *quantitative* increase in intelligence, or do these quantitative increases connote also a *qualitative* change in the mental function involved? We shall not attempt a lengthy discussion of this question in an effort to supply a definite answer; for psychologists are not agreed, nor is there sufficient evidence upon which to base a conclusive answer.

There is, however, reason to believe that mental growth

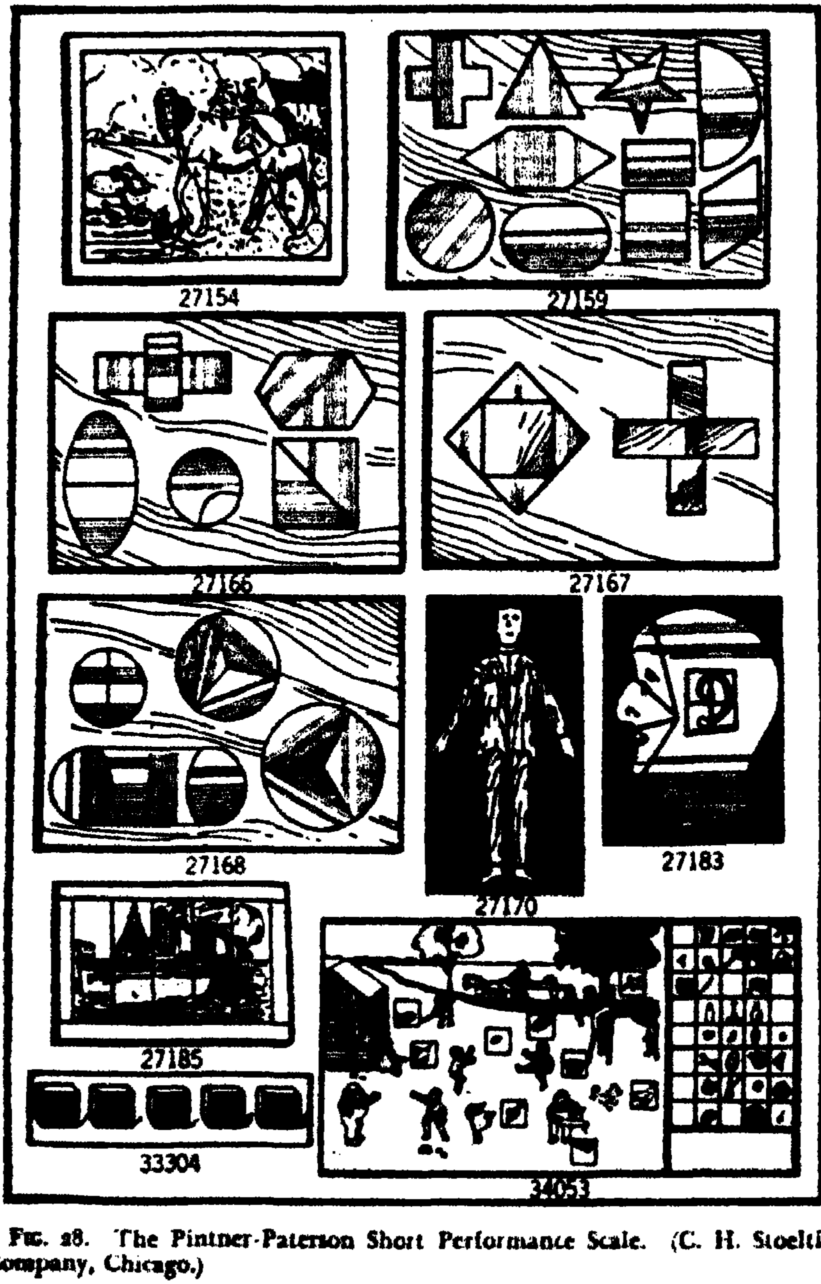

FIG. 28. The Pintner-Paterson Short Performance Scale. (C. H. Stoelting Company, Chicago.)

involves not only increments in amount of intelligence but that when the amount has increased sufficiently, *new forms emerge.*[10] For example, if young children are given a group of colored objects to arrange in classes, they will, at the earliest levels, assort them on the basis of a single category—color. Later there are two possibilities: namely, color and shape. Still later a third category, size, emerges. In other words, the number of categories has increased; they have emerged and become abstracted from the concrete objects themselves. This kind of development is an aspect of *differentiation* by means of which the environment is enriched and transformed.

Another example of qualitative change is that in which the child is able to grasp the concept of "opposites" or "likenesses."[11] He will be unable to apprehend the meaning and use of these concepts—even after much instruction—if he is as yet insufficiently matured. If, on the other hand, he has reached a level of adequate maturation, then a very few illustrations will suffice for him to "catch on" and to stay caught on. Similarly, as a child proceeds in the acquisition of vocabulary, from words of simple concrete objects up to the level of abstract concepts and relationships (like "justice" and "evolution"), his growth is not primarily that of mere addition, but it involves an actual qualitative change in his perceptions and behavior.

Additional instances can be supplied from other activities. In arithmetic there are some methods of reaching a solution which are less mature than others, the more mature involving reorganizations, short cuts, elisions, and others. In the performance test of the picture completion type, being able to insert several relatively simple pieces in a picture whose main outlines are given is a different kind of task from the

[10] This is true also of certain phenomena in the physical and biological sciences; as in the formation of a chemical precipitate, or (according to one theory) the emergence of a biological mutation.

[11] See Kreezer, G., and Dallenbach, K. M., "Learning the Relation of Opposition," *American Journal of Psychology*, vol. 41, 1929, 432-41.

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one requiring that entirely disorganized parts of a picture puzzle or of a mechanical device be assembled into the correct unit. The difference is not merely a matter of the difference in the number of pieces involved. It is a task of a higher level to create a new whole out of disorganized parts to which the individual himself must supply the general outline or form. The whole helps to determine its parts, even though several details are missing. These details will be judged according to their suitability to the whole. It is for this reason that the first task mentioned above is easier and qualitatively on a simpler level, whereas the second is more difficult and on a higher level, since no form or pattern is already provided.

Thus, in spite of the fact that a conclusion regarding the quantitative and qualitative aspects of intelligence is not unequivocally established as yet, there is strong evidence that mental growth involves both.

The Mental Age. Intelligence tests are employed primarily to determine the individual's level of mental ability and degree of brightness. Therefore, an index is necessary to show each individual's status. To indicate the first of these, the level, the *mental age* (M.A) is used. This is defined as the mental level of an individual, measured in terms of the average individual of the corresponding chronological age. An example or two will make this clear. For instance, a mental age of 10 signifies the degree of mental development attained by the average child of ten years. A mental age of 5 signifies the degree of mental development attained by the average child of five years; and similarly for other mental ages. Thus, if an individual attains a given mental age it signifies that his performance on the mental test equals the average performance of an adequate sampling of individuals of the same chronological age.

If a group test is used, the mental age is found by referring the individual's test score to a table of norms for that particular test. This table has been determined experimen-

tally by the scores obtained with large, representative samplings of subjects at different chronological age levels. If the Stanford-Binet is used the MA is found as follows: It will be recalled that the test items are grouped at various age levels, there being groups (in the 1937 revision) from two years upward. The age level at which the subject successfully "passes" or completes all items is called the "basal year." To the basal year are added credits, *in terms of months,* for all items successfully completed in subsequent levels. The mental age is thus the basal year plus the number of months credit obtained beyond that. For example, assume that a child completes all items at the six-year level. His basal year is, then, 6. Assume, also, that he completes two items at the seven-year level, for each of which he gets a credit of two months, or a total of four months. He fails all items at the eight-year level. His mental age, therefore, is 6 years, 4 months.

Since individuals differ with respect to mental abilities, as in other psychological and in physical traits, a wide range of mental ages is found among persons of the same chronological age. Thus, one child of ten may have an MA of 10; another, an MA of 12; still a third, an MA of 8. In the case of every individual, the mental age increases with his increase in chronological age, until the age at which the maximum is reached. The yearly increments will vary, of course, with the individual's rate of mental development which is held to be constant under ordinary conditions. Therefore, taking the example cited above, the first child (MA of 10 and CA of 10), who is developing at an average rate, will increase one year in mental age in each calendar year until his maximum is reached; the second child (MA of 12 and CA of 10), who is developing at an accelerated rate, will, theoretically, increase one and one-fifth years in mental age in the calendar year; while the third child (MA of 8 and CA of 10), who is developing at a retarded rate, will increase four-fifths of a year in mental age during the calendar year.

The chronological age at which maximum mental age is attained has not yet been definitely determined. Its determination is beset by numerous difficulties and circumstances which have not been and perhaps cannot be brought under control. However, under present conditions, and with available measuring instruments, most psychologists place the maximum somewhere between 14 and 16, while a few would place it between 18 and 20.[12] The maximum is fixed by the age at which the mental test records the highest average score for the group, and beyond which the test no longer records increasing average scores with increasing age. That is, if a particular test yields an average score for age 16 which is not exceeded by groups at ages 17, 18, 19, etc., the maximum mental age for that test is 16.

The fact that the test does not indicate further increases after age 16 may be due to the actual cessation of growth at that age in the functions being measured by the test. Or it may be that the nature of the test is such that it is incapable of measuring further increases or of differentiating between individuals beyond sixteen. There is still a third possibility, the implications of which will be dealt with in the next chapter: namely, it may well be that mental functions reach their maximum development at sixteen, or thereabouts, under environmental conditions *as they now are;* that is, under conditions of "intellectual nurture" as they now exist. But what the maximum would be under significantly improved conditions cannot be known until an actual trial is made. Nevertheless, there is some evidence to indicate that the maximum would rise.[13]

Differences in mental age indicate, of course, different levels of ability. They signify qualitative differences with respect to educability, the rate, depth, and range of learning,

[12] For a discussion of this problem, see Freeman, F. S., *Individual Differences*, pp. 233 ff.; also Garrett and Schneck, *op. cit.*, part II, pp. 14 ff.

[13] See Thorndike, E. L., *Adult Learning*, New York, Macmillan, 1928; also his "On the Improvement of Intelligence Scores from 14 to 18," *Journal of Educational Psychology*, vol. 14, 1923, 513-16.

and with respect, as well, to the adequacy of adjustment to new situations. It would be a mistake, however, to assume that the rate, effectiveness, and character of one's education and adjustment were contingent only upon his mental level. The rôles of interests, emotions, and personality traits make clear the error of any such assumption.

The Intelligence Quotient. From the illustration cited in the preceding discussion of mental age, it is apparent that individuals having the same mental ages are not necessarily of equal intelligence. The rate of mental development is not the same for all, so that some persons require a longer or a shorter time to reach a given level than does the average person. Thus, three children might have mental ages of 10; but child *A* is, say, 8 years old; child *B* is 10; child *C* is 12. Obviously *A* is the most intelligent of the three, for he has required much less time to reach the 10-year level than either *B* or *C*. Since, as already stated, the rate of mental growth is ordinarily constant, these three children will share the same mental level only very temporarily; for *A* is growing mentally at the rate of five-fourths of a year in a calendar year; *B* is growing at an average rate of one year mentally per calendar year; while *C* is advancing mentally only five-sixths of a year in each chronological year.

In order to show the differences in rate of mental growth (or degree of brightness) the *intelligence quotient* (IQ) is employed. This is obtained by dividing the individual's mental age by his chronological age. The intelligence quotient is thus the ratio of the MA to the CA, showing whether mental growth is keeping pace with increase in chronological age, or whether it is accelerated or retarded. Taking the three children—*A*, *B*, *C*—mentioned above,[14] *A* has an IQ of 125, *B* has 100, and *C* has 83. Now, therefore, if we were to give the mental status of any one of these children, as revealed by the test of intelligence, we should give both mental age and intelligence quotient. As a result, no one would be

[14] Decimal points are dropped in giving the IQ.

misled, in the example cited, into assuming that the three children were of equal intelligence; for the differences in IQ would reveal that we are dealing with a bright, an average, and a dull child.

When a large representative group of the population are measured with respect to intelligence, it is found that their intelligence quotients distribute themselves in a manner that closely approximates the "normal frequency" curve (Figure 30). That is to say, there is a continuous gradation from one extreme of mental ability to the other, showing a concentration of individuals about a central point, with the frequency of cases decreasing as the distance from the central tendency increases. Thus, by means of the IQ we are enabled to judge not only the individual's rate of mental development with respect to the functions measured and his apparent degree of brightness or dullness, but we can judge his relative position with respect to the group as well. The following theoretical tables are based upon a population that is presumably representative of the American population at large.

The	lowest	1	percent	reach	a	maximum	IQ	of	70
"	"	2	"	"	"	"	"	"	73
"	"	3	"	"	"	"	"	"	76
"	"	5	"	"	"	"	"	"	78
"	"	10	"	"	"	"	"	"	85
"	"	15	"	"	"	"	"	"	88
"	"	20	"	"	"	"	"	"	91
"	"	25	"	"	"	"	"	"	92
"	"	33.3	"	"	"	"	"	"	95
The	highest	1	percent	reach	a	minimum	IQ	of	130
"	"	2	"	"	"	"	"	"	128
"	"	3	"	"	"	"	"	"	125
"	"	5	"	"	"	"	"	"	122
"	"	10	"	"	"	"	"	"	116
"	"	15	"	"	"	"	"	"	113
"	"	20	"	"	"	"	"	"	110
"	"	25	"	"	"	"	"	"	108
"	"	33.3	"	"	"	"	"	"	106

For purposes of diagnosis, intelligence quotient classifications are usually made as shown in the following table, although it must be emphasized at once that lines of demarcation between classes cannot be sharply drawn; the IQ must be interpreted as only one aspect of the individual's entire delineation.

IQ	*Class*
0-24	Idiot
25-49	Imbecile
50-69	Moron
70-79	Borderline
80-89	Dull or Backward
90-109	Normal
110-119	Superior
120-139	Very Superior
140 and above	Near "Genius" or "Genius"

Although mental ages and intelligence quotients are given as numbers, it must not be assumed that they can be quantitatively interpreted in the same manner as measures of physical properties. For instance, if a very young child is three feet tall, he is obviously one-half as tall as an adult six feet in height. Similarly, a person who weighs one hundred pounds is half as heavy as one who weighs two hundred. But, unfortunately, we cannot say, for instance, that a child having an IQ of 100 is twice as intelligent as the one having an IQ of 50. The fact is that we should be nearer right if we guessed that the former is six or eight times as intelligent. But such comparisons are much less important psychologically and educationally than our ability, on the basis of a validly established intelligence quotient, to predict, within narrow limits of error, a child's probable rate and extent of learning, the quality of his learning and achievement, and the levels of activity which are probably open or closed to him because of the character of his mental traits. The reader will note that we have qualified our statements regarding the predictive values of intelligence quotients, the

reasons being that learning and achievement are not merely the results of sheer intelligence, and that in some instances special abilities in a particular field will enable an individual to attain levels of achievement beyond those indicated by the intelligence quotient.

Some Complicating Factors. In our preceding presentation, we have deliberately oversimplified the discussion of mental age and intelligence quotient because it is our primary concern to present only the general character of intelligence tests and the methods of recording results, rather than to deal with the many specialized problems that demand and receive attention in the detailed study of mental measurements. Yet there are several factors that merit attention even in a very general presentation.

The implication of our discussion is that the intelligence quotient is constant in an individual until decline sets in late in life. And, as a matter of fact, the evidence indicates that *under ordinary circumstances,* and in the great majority of cases, the IQ does remain constant for all practical purposes. Changes of about five points one way or the other are not regarded as serious; although numerous studies have shown that the average variation upon successive examinations is less than that. "Errors of measurement" must be taken into account in all fields, even in the physical sciences where the materials of study and experimental conditions are under as rigid and precise control as can be attained. It is not surprising, therefore, that the results of mental measurements are not altogether uniform, for the human subject is not a completely stable and consistent entity, nor is the subject himself the only human factor involved. There is also the "personal equation" of the examiner to be considered when individual tests like the Binet are used. Furthermore, the tests themselves are not infallible. It is thus easy to see that fluctuations of a few points in IQ from examination to examination are not matters of concern.

Quite aside from the above-mentioned factors, there are

others which may cause significant changes in a child's intelligence quotient, some of these changes being real and others only apparent.

First, there are, in some instances, appreciable irregularities in physical and mental growth. There are cases of children whose growth in both respects slows down temporarily and then suddenly spurts, while in others the slower rate of development continues throughout the growth period. In either event, the irregularities in rate will be reflected in intelligence quotient changes.

Sensory defects, such as seriously impaired vision or hearing, or total blindness or deafness, will, of course, adversely affect a child's performance on a mental test. In some instances the decline in rank is more apparent than real simply because the test used is not suitable for one who is handicapped by such defects. If the defect—whether total or only partial but serious—has developed in early childhood during the years in which the most rapid and significant growth ordinarily takes place, it is still an open question what actual effect is produced upon mental development by the loss of an avenue of experience so important in the stimulation of the mental processes. This problem is still relevant, even though we employ forms of mental tests especially devised for the deaf or the blind.

Even though the partial or complete loss of a sensory function did not actually affect mental abilities adversely, it is still possible that a child so afflicted will appear to rank lower than formerly because nearly all tests are devised for use with children who have had opportunities to participate in the usual and common experiences of an ordinary environment, whereas a blind or partially blind child and a deaf or partially deaf child are not living and experiencing as are children having normal or practically normal vision and hearing.

More frequently than not, psychologists hold that ordinary diseases of childhood have little harmful effect upon

the growth of intelligence. Their contention is that such unfavorable conditions as malnutrition, defective teeth, diseased tonsils, enlarged adenoids, simple goiter, hookworm, intestinal toxemia, etc., have little or no influence upon mental development; and their data, in the mass, seem to support that contention.[18] But the problem is not so simple nor the answer so clear as they seem to be.

Aside from obvious inefficiency in performance (as distinguished from potentialities) in children of poor health, we should recognize certain inadequacies in these investigations which make their conclusions less valid, and for the following reasons. The subjects studied were school children already well along in their development, even though only six or seven years of age. In other words, permanent damage, to some degree, might already have been done; for the duration and seriousness of the deleterious influences due to abnormal conditions have not been ruled out. Implicit in most of the studies, and explicit in some, is the assumption that if intellectual improvement is to come with remedied conditions of health, it must come regardless of how long or how serious the individual's pathological history might have been before he came under observation and treatment. No such assumption is warranted. Until we have data and other facts derived from situations in which these weaknesses are eliminated it will not be possible definitely to determine the actual effects of pathological conditions upon mentality. All that can be said now is this: under present conditions, and taking children at a relatively advanced period in their developmental histories, medical and surgical treatment ordinarily do not materially improve their intellectual status. We must attach to the earliest years of life additional significance in the mental nurture of the child, if for no other reason than that the deleterious influence of harmful physical conditions during those years

[18] See, for example, Paterson, D. G., *Physique and Intellect*, New York, Century, 1930.

has not been ruled out as a factor in mental growth. Furthermore, at the present time it is not known what would be the effects of protracted physical handicaps, such as those enumerated, upon one's mental status.

Besides the question of one's best mental level, the matter of physical disease is relevant to actual achievement or mental efficiency. Even if serious physical ailments might not appreciably affect mental growth, still they might significantly reduce the actual functioning of a person's abilities. Thus, at times an important change in a subject's intelligence quotient might signify either the appearance or the elimination of a health factor handicapping performance, depending, respectively, upon whether the change is a loss or a gain.

The intelligence quotient may be affected also by alterations in the environment, especially in the earliest years. This topic is discussed at greater length in the next chapter; but for the present we may mention such factors as language handicaps, cultural opportunities, and schooling. In some cases, the rise in mental status is a genuine one; in other instances it is only apparent, as when the language handicap is removed in the case of a child who knows little or no English.

Finally there are spurious increases or decreases in the IQ as a result of temporary or accidental factors. Such increases might result from specific practice or coaching for a particular test; while such decreases might result from negativism [16] (especially in young children) or other emotional disturbances which interefere with one's performances.

The fact that in some instances we find significant changes in intelligence quotients on successive examinations does not invalidate or even reduce the value of the IQ; for when such discrepancies are found we have evidence warranting,

[16] Negativism is an attitude characterized by strong resistance to suggestions coming from others, even to the point of doing the opposite of what is suggested.

in fact, demanding, that the case be studied for the purpose of uncovering some unusual factor or factors which are important in understanding the individual concerned.

In our discussion of intelligence up to this point we have concerned ourselves with definitions and theories of intelligence, in an effort to describe how it works and why it works that way. Also, we have sketched briefly the methods of measuring mental capacity and the most common means of representing performance upon these tests: namely, mental age and intelligence quotient. It has been stated, too, that in the population at large there is wide variation in capacities; but the causes of variation have not yet been presented. To these we now turn our attention; for the causes, as well as the nature of variations, have an important bearing upon educational and social procedures.

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Chapter XVII

INDIVIDUAL DIFFERENCES: THEIR NATURE AND CAUSES

Introduction. The existence of significant individual differences in intelligence has long been known. They are recognized in the educational theories of Plato and Aristotle, as well as in the doctrines and practices of most educational theorists and pioneers since. Their views, until about fifty years ago, were based almost entirely upon casual observation alone; not upon systematic and experimental study. In fact, the most important and illuminating work in this field has been done in the last 25 years—that is, since the advent of tests of intelligence.

Our knowledge of human variability in the higher, more complex processes has grown in range, detail, and validity, in spite of the fact that definitions and theories of intelligence differ, and in spite of certain limitations at present inherent in the tests being used.[1] The fact is, nevertheless, that all things being equal, the best of available standardized tests now provide the most reliable method of determining mental ability.

Francis Galton, to whom standardized mental tests were not available, was strongly influenced by the biological movement of the latter half of the nineteenth century and may be regarded as the first one to have made systematic studies of the most fundamental question in the entire problem of individual differences: namely, heredity and environ-

[1] See, for example, Freeman, F. N., *Mental Tests*, Boston, Houghton Mifflin, 1939, chaps. 9, 10, 11.

ment; or, as Galton so aptly called it, nature and nurture.* In this chapter we shall be concerned not only with these two basic and primary factors, but also with the place of a group of secondary factors—sex, age, nationality, and so-called race—as they operate in the production of individual differences in intelligence. We shall also deal briefly with the extent of variations in intelligence, as well as with the

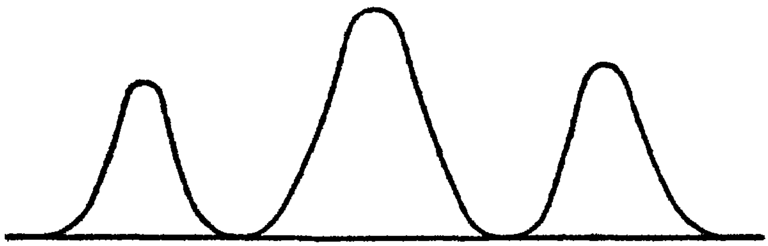

FIG. 29. A multimodal curve

educational implications of the contributing factors and range of differences.

The Notion of Types. Contrary to popular opinion, individuals do not fall into distinct types, so far as psychological traits are concerned. Scientific doctrine has discarded the erroneous notion that persons are either "visual-minded" or "auditory-minded," "mechanical-minded" or "language-minded," musical or unmusical, artistic or inartistic, athletic or unathletic, intelligent or unintelligent, of good disposition or bad disposition. It is equally unsound to attempt to divide the population into introverts and extraverts, the subjective and objective, the practical and theoretical, ascendants and submissives, as indicated in Chapter IV.

Such dichotomies have always proved to be unsatisfactory because mankind does not lend itself to simple two-fold divisions. As a matter of fact, human beings in their range and complexity of variability can no more be properly classified

* The character of his studies may be seen from the titles of his books: *Hereditary Genius* (1869); *English Men of Science: Their Nature and Nurture* (1874); *Inquiries into Human Faculty* (1883).

as members of one or another of these types than they can as giants or dwarfs, geniuses or idiots. This does not mean, however, that there are no individuals at either extreme in these and other traits. But it does mean that when persons in general are studied, it is found that instead of two opposed types there is a continuous gradation from one extreme to the other, showing a concentration of individuals

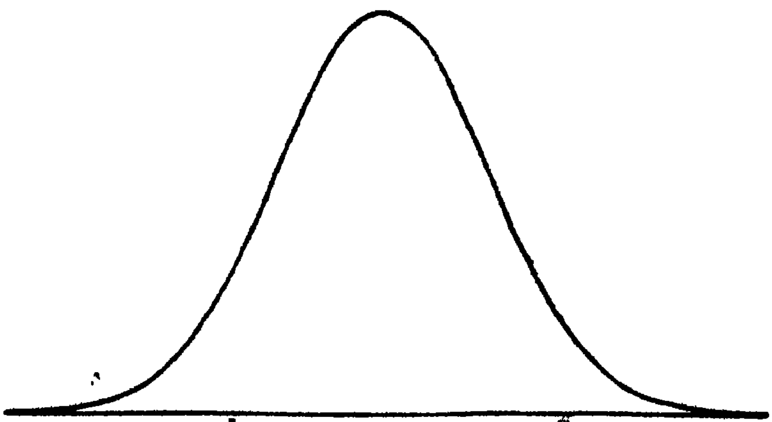

FIG. 30. The normal probability curve.

about a central point (the average) with the frequency of occurrence decreasing as the deviation from the central tendency increases.

If it were true that human beings are divisible into clearly defined types or classes, statistical distributions of the measurements of a particular trait should reveal a bimodal or multimodal curve; that is, a curve having more than one mode or point of concentration at or near which a large portion of the population will group themselves, with significant gaps existing between the modes. In other words, there should be a mode for each alleged type. Such a multimodal distribution would be portrayed by the curve shown in Figure 29.

On the contrary, however, studies of human characteristics and abilities yield curves with a single mode (Fig. 30).

nifying there is one type—namely, the average, or mediocre—and that cases occur with decreasing frequency as the amount of the trait deviates from the norm in either direction.) Figures 30 to 33 illustrate this fact. The first of these is the theoretical "normal frequency curve." Figure 31

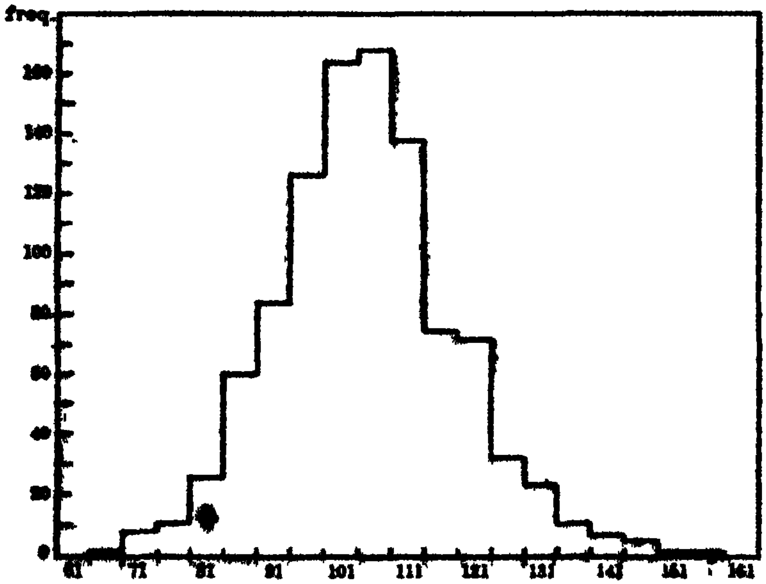

FIG. 31. Distribution of intelligence quotients of 1001 first-grade children. (From M. M. Wentworth, *Individual Differences in the Intelligence of School Children*, Harvard University Press.)

shows the actual distribution of intelligence quotients of 1001 first grade children, with an average IQ of about 100 and a range from about 60 to 160. In Figure 32 we have a distribution of scores made by a group of college freshmen on a test of scholastic aptitude. Much the same kind of graph would be obtained if we were to measure other functions such as those involved in rate of reading, copying digits or letters, motor skills, and so on. The same type of curve is found when physical measurements are taken, as shown in Figure 33, representing the distribution of heights of 8585 men. It is now the orthodox doctrine that human traits are distributed as indicated by the "normal frequency curve."

It is conceivable that under special conditions of growth and education, rather well-defined groups might be created; although even so there could still be overlapping of groups. For example, there probably would be a bimodal curve of physical measurements if half of the children were undernourished and malnourished from early infancy, whereas the other half were nourished under ideal conditions; in social attitudes, if half were educated in the traditions of a culture

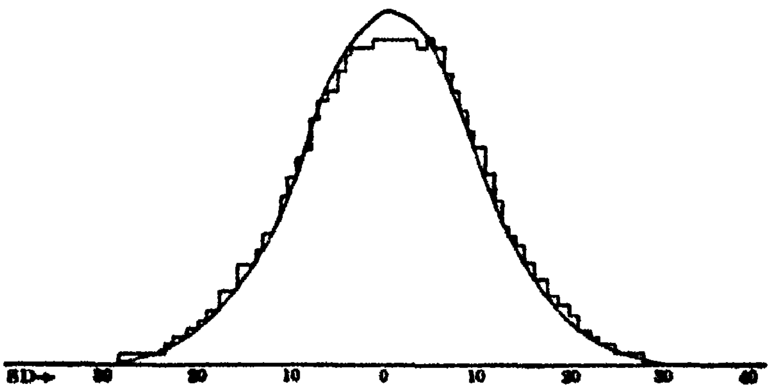

Fig. 92. Distribution of college freshmen test scores. (From E. L. Thorndike, *The Measurement of Intelligence*, Bureau of Publications, Teachers College, Columbia University.) The smooth line is the theoretical normal curve.

diametrically opposed to the traditions of the other half; in linguistic ability (or any other) if half were educated in an environment designed to foster and conserve that ability while the other half matured in an environment barren of the necessary educational influences. (But all things being approximately equal, the nature and extent of individual differences in a particular trait or complex of traits is represented by the unimodal curve which portrays the extent of variations among the population in the given trait under conditions as they now are.)

The educational implications of the distribution of human abilities, though readily discerned, are very significant. In the first place, since the general population is not divisible into two or three ready-made classes in any [illegible]

logical traits that have been investigated, there are no readily available fixed categories which the school can employ for the purpose of differentiated instruction.) Nevertheless, as a second consideration, the range of abilities as shown by the unimodal curve is such as to make imperative differentiated educational procedures, whether by acceleration or enrichment, or both; whether by homogeneous

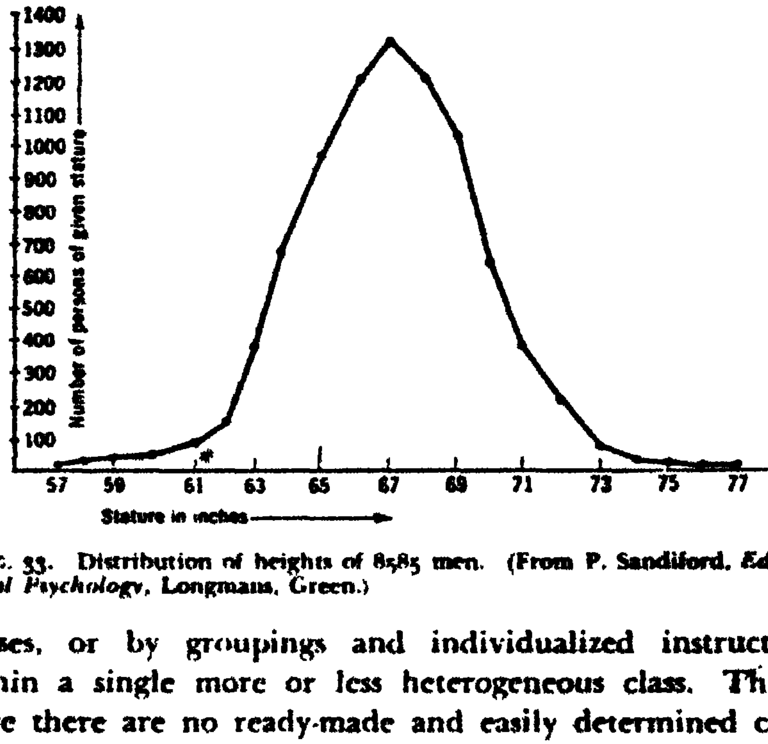

FIG. 53. Distribution of heights of 8585 men. (From P. Sandiford, *Educational Psychology*, Longmans, Green.)

classes, or by groupings and individualized instruction within a single more or less heterogeneous class. Third, since there are no ready-made and easily determined categories or types, the problem of classification for purposes of instruction is the harder, presenting administrative as well as instructional difficulties. Finally, because individuals do not fall readily into one type or another, each supposedly having its own exclusive characteristics, the importance of the *individual*, not of an alleged type, is emphasized. The important question is this: What factors or influences are responsible for individual differences? To these we now turn.

The Rôle of Inheritance: Genetic Theory.[3] Individuals differ genetically at the beginning of their existence when the germ cells of the two parents unite to form the new individual. Each new individual starts with his own particular set of genetic elements—the *genes*—which in their diverse and numerous combinations yield all varieties of structural, physiological and mental differences. These genes, contributed directly by the parents, are the biological basis of individuality.

Each parent contributes to the new cell one set of genes, the corresponding genes of which unite to make a double set, containing elements necessary for the formation of a certain characteristic of the newly conceived individual. For the matter at hand it is important to note that the germ cell *of each parent contains many, many thousands of genes, that* there are diversities *among the sets of each parent,* and that in the newly fertilized egg the substances of both parents are united to form new combinations. These facts of genetics afford insight into the reasons why it is extremely improbable that any two individuals, even within the same immediate family, will be developed out of identical gene combinations, excepting identical twins, of course, who develop from the division of a single fertilized ovum. To state it differently, the germ cells of each parent do not all carry identical trait potentialities; moreover, they carry potentialities which have not appeared in the parent himself. Add to this the fact that the biological inheritance of every child is a bi-parental matter, and the probability of identity or near-identity of genetic elements in siblings is again greatly reduced.

Furthermore, a trait is not simply the product of a single gene. For example, to produce the eye color in the fruit-fly it has been found that at least fifty genes interact. This

[3] For a technical presentation, see Morgan, T. H., *Embryology and Genetics*, New York, Columbia University Press, 1934; a less technical one is by Altenburg, E., *How We Inherit*, Holt, 1928.

being true of a relatively simple trait, what then must be the complexity of gene interaction in the production of the highly complex physical correlates of those functions we call intelligence! Complexity and extensiveness of gene interaction furnish *one* reason for the absence of complete correspondence of different abilities within an individual, as well as for the lesser correspondence of the same abilities among members of the same immediate family.

Genetic theory places emphasis upon the individual; for it makes amply clear the fact that a considerable degree of variation may occur among children of the same parents, and between parents and offspring, so far as genetic constitution is concerned. This variation is just as consistent with the gene theory of biological inheritance as are the resemblances between siblings, and between parents and children. The fact, then, is that the individual need not *necessarily* fear relegation (nor may he necessarily look forward to the same mental level as that of his parents), as the case may be. Nor have his older siblings necessarily defined his mental status for him. In general, however, it is true that the new individual will tend to approach the levels of the other members of his immediate family. The significant positive correlations between abilities of members of the same family demonstrate this. Nevertheless, there are marked deviates, as when a very gifted or a very stupid child appears in a family where none such have appeared before—at least within memory or record.

The Rôle of Inheritance: Family Resemblances. The rôle of immediate inheritance in the determination of individuality has been often investigated through the study of trait resemblances among members of the same family. The underlying assumption, in this method, has been that if significant correlations were found between siblings, on the one hand, and between parents and children, on the other, these correlations could be taken as evidence of the primary and perhaps exclusive importance of heredity, since mem-

bers of the same immediate family are of the same stock.

For the moment we shall not attempt to evaluate this assumption, but shall, instead, present the results. Since the widespread use of standardized psychological tests, numerous correlational studies have appeared, comparing the mental abilities of brothers, brothers and sisters, sisters, fathers and children, mothers and children, children and mid-parent (average of performance by mother and father). The correlation coefficients, though not uniform, have fallen for the most part between +.40 and +.60, the average being about +.50. There are instances where the coefficient is as low as +.30 or as high as +.70; but +.50 may be regarded as most representative.

Twins, however, provide better materials for study than do ordinary siblings, because, in the first place, their environments are more nearly alike, and, in the second, genetic constitution is a constant factor if they are identical twins. This constant enables us to evaluate environmental influences, since any differences between identical twins would be ascribable to the environment. Furthermore, data obtained with twins, identical or fraternal (non-identical), may be compared with data on siblings; and from such comparisons certain conclusions emerge.

A typical study of twin resemblances was made by Merriman.[4] His subjects were rated or tested by means of one or more of the following: teachers' estimates, Stanford-Binet test, Army Beta test, and the National Intelligence test. As usual, the data were correlated, with the following results:

Class	*Average Correlation*
All twins-pairs	+[illegible]
Like-sex pairs	.90
Girl-girl pairs	.89
Boy-boy pairs	.92
Unlike-sex pairs	.70

[4] Merriman, C., *Intellectual Resemblances of Twins*, Psychological Monographs, no. 152, 1923-24.

Several important facts emerge from these data. First, the relationship between *all* twins is much closer than between ordinary siblings, for whom the average coefficient of correlation, it will be recalled, is +.50. Second, the coefficients for like-sex pairs are significantly higher than for unlike-sex pairs.

It must be borne in mind that unlike-sex pairs cannot be identical twins, and that like-sex pairs include all the identicals and possibly some who are only fraternal twins. Thus, the higher coefficients obtained with the twins of like-sex (.90, .89, and .92) might well be due to the identical genetic basis of certain of the twin pairs. That is, the higher coefficients found with like-sex pairs—which include the identical twins—furnish evidence for the view that intellect, as measured by the tests, is a matter of genetic determination to a significant degree.

But that is not all; for the coefficient of .70, found with unlike-sex pairs, or fraternals, must be explained. Now, so far as genetic bases of individuality are concerned, *fraternal twins are not different from ordinray siblings.* Fraternal twins have developed from two separately and independently fertilized ova which have grown and matured simultaneously. Thus, if intellect were simply a matter of an individual's genetic constitution, there should not be a closer correspondence between non-identical twins than there is between ordinary siblings. Yet, the average coefficients are +.70 and +.50, respectively. This difference, then, must be attributed to the greater constancy or similarity of environmental influences, including pre-natal conditions.

In the case of twins, identical and fraternal, the conditions of life after birth are much more likely to correspond than in the case of ordinary siblings who might be born and might develop under appreciably diverse conditions. Furthermore, the similarities of twins, even if they include

no more than the birthday, are stressed; and often a conscious effort is made not to discriminate between the pair in any manner. But for ordinary siblings economic, physical, and social factors are not necessarily constant; parental competence and skill with respect to child-training may and do change; and parental preferences are not unknown. Add to these factors the many subtle variations in surrounding conditions and the many inevitable individual experiences, and serious doubt is cast upon any view that environmental factors have been practically identical in the developmental histories of siblings.

Identical Twins Reared Apart. The best subjects for the study of the rôles of nature and nurture, as they affect mental and physical development, are identical twins who have been reared *apart*. Since such twins have developed from a single fertilized ovum, they have identical genetic elements. Therefore, any mental or physical or personality differences existing between them must be attributed to environmental influences, including the pre-natal period.

At present, we have data on a sufficient number of pairs reared apart enabling us to say that the results are not entirely consistent or unequivocal. With respect to emotional and temperamental traits, in ten pairs there were three instances of similarity and seven of dissimilarity. In four cases out of ten, the twins were dissimilar in respect to both mental ability and temperament. Of the ten pairs studied, in no instance were the twins alike in both respects, although in three pairs the disparities were rather slight.[5]

The outstanding conclusion from the study of identical twins reared apart is that each pair offers a distinct problem which must be studied in itself, and with respect to the particular factors involved in each situation. Although it is not always possible to generalize from one instance to another, it

[5] See Newman, H. H., "Mental and Physical Traits of Identical Twins Reared Apart," *Journal of Heredity*, vol. 20, no. 1, pp. 49-64; no. 3, pp. 97-104; no. 4, pp. 153-66; vol. 23, no. 1, pp. 3-18; no. 8, pp. 297-304; no. 9, pp. 369-77; vol. 24, no. 5, pp. 209-14.

appears, nevertheless, that in an explanation of individuality the extreme hereditarian notion must be abandoned; since appreciable trait differences reported for these identical twins, as well as other evidence, demonstrate that human nature is susceptible to environmental influences. The degree to which environmental differences will influence individualities of twins depends upon two factors: first, the age or developmental phase during which they were separated; and second, the length of time they were separated. It is not only a question of the *amount* of time spent in separation; the *period* is even more significant, the earlier years, especially the first six or eight, being the most important.

Evidence that individuality in contemporary communities is not simply a matter of hereditary determination (genes) makes the problem of the educator the more perplexing and challenging. In evidence showing the relative initial indeterminateness and malleability of certain human traits, the educator should find the possibilities of individual and social integration.

Environment and Mental Development. An early and favorite method of investigating the effects of nurture is the study and evaluation of environmental conditions of men and women of distinguished achievement. In the United States, the first such investigation presented the birthplaces and residences of a thousand leading scientists, the purpose being to shed light on the problem of nature, nurture, and achievement.[6] In different sections of the country, striking inequalities were found in the production of scientists. Cattell showed the close relationship existing between the environmental quality of different sections of the country and the frequency with which scientists were produced in each. These inequalities of production, he wrote, seem "to be a forcible argument against the view . . . that scientific performance is almost exclusively due to heredity."

[6] Cattell, J. McK., "A Statistical Study of American Men of Science," Science, N.S., vol. 24, no. [illegible], 1906, [illegible]-42.

Cattell in 1915 published additional data bearing out the conclusions reached in the 1906 publication.[7] Also, data for the year 1932, concerning 250 leading scientists, lead once more to the same conclusions.[8] Thus, while admitting the importance of the genetic basis of an individual's capacities, we may attribute to environmental factors one of the major rôles in creating individual differences as they are manifested in performance.

Another method used in studying influences of environmental conditions, and rather widely employed, is the comparison of the intellectual status of children coming from various occupational and social groups. Data from these investigations are not always unequivocal; for it is not easy to distinguish between relationships that are merely concomitant and those that are cause and effect. If they are of the latter sort, the determination of which is cause and which is effect is still a difficult problem. However, the results of many and varied studies, each having its own characteristics and supplementing the others, lead to certain reasonable conclusions that help to clarify the nature of the relationships.

A unique and significant study was made of the intelligence of a group of canal-boat children.[9] These children lead an unusual life, being cut off, most of the year, from schools and ordinary social intercourse, except for the very limited contacts supplied by their own families. Many adults of the canal-boat population are unable to read or write; and their "intellectual life" is of the most meager kind. Thus the children spend their plastic and developmental years in an environment of social isolation and intellectual barrenness.

[7] "Families of American Men of Science," *Popular Science Monthly*, vol. [illegible], no. 5, 1915, 504-15.

[8] Cattell, J. McK., and J. (eds.), *American Men of Science* (5th edition), New York, Science Press, 1933, pp. 1261 ff.

[9] Gordon, Hugh, *Mental and Scholastic Tests among Retarded Children*, London, Board of Education, Educational Pamphlet no. 44, 1923.

The average IQ of the canal-boat children was 69.6; that is, according to the conventional classification, on the margin between the mentally defective and borderline groups. But the remarkable fact revealed was that the intelligence quotients of children within the same family *decreased as age increased*. The rank correlation coefficient between IQs and life age was —.75, indicating a high inverse relationship. The age-group from 4 to 6 had an average IQ of 90 ("low normal"), whereas the group from 12 to 22 had an average of 60 (a rating of mental deficiency). From these data, it appears that the restricted character and limiting effects of the impoverished canal-boat environment had much less serious consequences in the case of the younger children. They appear to be about "normal" in intelligence, because performance on the tests of the earlier years does not suffer from restricted social and intellectual surroundings to the same extent as in later years. The social and intellectual needs of young children are fewer and simpler; they are thus more likely to find adequate an environment which, as they grow older, is inadequate, for it suffers from a paucity of social and mental opportunity. Thus, in this illuminating study we have evidence indicating that the extent and form of mental development are dependent in part upon factors in the individual's environment during his developmental years.

Children in Foster Homes. We are led to the same conclusion by an extensive study dealing with the mental growth of foster-children after they have lived in their new homes.[10] On the whole, they improve their mental status, the extent of improvement being contingent upon the quality of the foster-home, the length of residence there, and the age at which the child entered the new environment. It was found, also, that siblings living in different foster-homes

[10] Freeman, F. N., *et al.*, "Influence of Environment on the Intelligence, School Achievement, and Conduct of Foster-Children," *Twenty-Seventh Yearbook, National Society for the Study of Education*, 1928, part I, chap. 9.

resemble one another much less than brothers and sisters ordinarily do, the coefficient of correlation being about +.25. Further, the degree of their resemblance varied with: (1) the length of time they had been reared apart; (2) the age of separation; and (3) the quality of the foster-home.

In general, the results demonstrate that improved environmental conditions which endure can raise the level of intelligence, if optimal conditions are provided early in life. The possibility of raising one's intellectual status is admitted even by some writers who belong to the "hereditarian school." One of them states: "The maximal contribution of the best home environment to intelligence is apparently about 20 IQ points, or less, and almost surely lies between 10 and 30 points. Conversely, the least cultured, least stimulating kind of American home environment may depress the IQ as much as 20 points. But situations as extreme as either of these probably occur only once or twice in a thousand times in America." [11] A possibility of variations within 30 or perhaps 60 points *is* extremely important. But it remains to be seen what the actual limits and range are and what the actual frequency may be. For to say that such changes will occur only once or twice in a thousand times is mere assumption.

Children's Intelligence in Relation to Parental Occupation. The nature of a child's intellectual, physical, and social environment is dependent to a significant degree upon the parent's occupation. In studying the influence of environment, therefore, we are justified in finding the relationship that exists between mental abilities of children and occupations of parents.

It has been shown that the higher the fathers' vocational ratings, the higher are the *average* mental ratings of the children. This has often been interpreted as showing only

[11] Burks, B. S., "The Relative Influence of Nature and Nurture upon Mental Development," *Twenty-Seventh Yearbook*, National Society for the Study of Education, 1928, part I, chap. 10.

the force of inheritance; for it is argued that in the long run persons of superior mental ability will find their way to the higher and preferred vocations, whereas people of inferior abilities will in general gravitate toward the lower and humbler occupations. Thus, it is maintained, it is only natural that children whose fathers (or mothers) are on the higher occupational levels should surpass in mental capacity children whose parents are in the lower occupations.

Unfortunately, many investigators have overemphasized the differences in *group averages*, while they have underemphasized the great overlapping of groups. The fact is that many children of vocationally superior parents fall below the average level of children of vocationally inferior parents. Also many of the latter children surpass the average of the former. These facts can be explained by: (1) genetic theory; (2) increasingly widespread knowledge of pre-natal, infant and child care; (3) the greater availability of agencies for child welfare; and (4) in particular by the character of education in the United States, which contributes to an equalization of intellectual environments, although free public education by no means effects a complete equalization.

Thus, our present knowledge of the extent and causes of individual differences in mental abilities offers no justification whatever for differentiating educational opportunities on the basis of a child's social or economic origin and status.

An enlightening study of 508 pupils has shown that *more than three-fourths* of the children who are above average in intelligence come from the less favored economic levels; that is, their parents are in occupations lower in rank than professions and executives of bigger business and industry.[29] It is true, also, that the *average* intelligence of children in-

[29] Stoke, S. M., *Occupational Groups and Child Development*, Cambridge, Harvard Monographs in Education, no. 8, 1927. Essentially the same results were found by Lawrence, E. M., *An Investigation into the Relation between Intelligence and Inheritance*, London, British Journal of Psychology, Monograph Supplement, vol. 5, no. 16, 1931.

creases with the rise in parental occupational level and that the highest occupational group contributes much more than its *proportionate* share to the ranks of superior children. In this last fact there is evidence of the genetic factor. Unless environmental factors are taken into account, it would be unreasonable to expect to find three-fourths of the *absolute* number of these superior children coming from parents who, in general, are not of superior mental ability. The integral character of genetic constitution and environmental influences (educational, social, and medical, but as yet certainly not optimal for all) will account for the facts revealed in the study cited above.

"Nature-Nurture." In several ways, studies have shown the importance of genetic constitution (inheritance), the significance of which in the formation of individuality cannot be questioned. At the same time, however, other studies have demonstrated the importance of environmental influences in individual development. Nature and nurture, therefore, may no longer be set against each other, for each is conceivable only as one factor, or set of factors, in a total situation. Indeed, one has no meaning without the other. Thus, instead of writing "nature *and* nurture," we should write "nature-nurture," for the two sets of factors exist as integrals in a single process of development. The two are mutually *inclusive*, since innate propensities are capable of expression only in terms of environments, and environmental influences can only act together with the genetic bases of individuality.

Enlightened educational practice, therefore, will seek to furnish every individual with conditions as near optimal as possible; not because such conditions will directly change the inherited capacities of the progenies of these individuals, but because ordinarily in no other way can it be known to what extent an individual's constitution is capable of developing. The earlier the optimum conditions are provided, the less may be "the limitations imposed by nature." [illegible]

the other hand, the extreme hereditarian viewpoint were adopted, it would mean that the chief or sole function of the educative process would be merely the imparting of information and the development of specified habits. In that case, education as growth, as development, and as the formation of individualities would be a fiction. Fortunately, the practices of the schools recognize, at least implicitly, the integral character of heredity-environment in the developmental process.

The Rôles of Race and Nationality. Much nonsense has been expressed concerning racial and national differences in intelligence, the burden of the argument being that some groups are *by nature* intellectually superior to others. The fact is, however, that there are at present no "pure" races, particularly not in the United States and Europe. Anthropologists are agreed, it seems, that at one time there were certain primeval races from which all others have been derived by crossing, so that contemporary groups have lost their definiteness through intermixture.[13] Consequently, there are no demonstrable innate intellectual differences to be found between so-called racial groups—e.g., Alpine, Nordic, Mediterranean. What differences do exist are the result of cultural variations and discrepancies—environmental in the broadest sense.[14]

What is important is the fact that *within* every "racial" and national group there are great and significant variations in traits of mentality, personality, and physique. Therefore, educational differentiation cannot rest upon "racial" or national membership. Instead, differentiation becomes an individual matter.

This doctrine applies to the North American Indian and the American Negro as well as to others. It is true that psychological measurements have shown these two groups to

[13] See, for example, Boas, F., *Anthropology and Modern Life*, New York, Norton, 1928.

[14] For a survey of materials on various aspects of the problem of race differences, see Klineberg, O., *Race Differences*, New York, Harper, 1935.

be inferior to the white population in *manifested* intellectual abilities. But disparities in social, educational, economic, cultural, and hygienic factors are so marked as to make impossible any conclusions at present with respect to inferiority or equality of their *innate* potentialities, as compared with the white man's. It remains for the future to demonstrate whether North American Indians and Negroes are by their genetic natures inferior to whites. Such may or may not be the case. What present data do show is that under existing conditions of environmental inequality they have, as groups, failed to reach the levels attained by contemporary whites. Nevertheless, mental tests reveal that at least 25 percent of Negro school children reach or surpass the average performance of white children.[15]

Some writers have labored to demonstrate that even though "pure" races are not to be found in this and other countries, there are, nevertheless, within political units rather well-defined groups which, with time, have advanced toward uniformity of language, mental traits, and physical characteristics. And, they maintain, some of these "national-racial" groups are by inheritance intellectually superior to others.[16] The notion of Nordic superiority is a case in point. To support their argument, the protagonists of this view cite as evidence the fact that mental tests of the foreign-born in the United States show in general that immigrants from Nordic countries rank higher than those from Alpine or Mediterranean countries.[17] Bagley, however, has presented a compelling counter-argument showing that there is a very high degree of correspondence between immigrants' mental ratings and the educational and cultural status of their na-

[15] For details, see Pintner, R., *Intelligence Testing*, New York, Holt, 1931, chaps. 20 and 21; and Freeman, F. S., *op. cit.*, chap. 5.

[16] Huxley, J. S., has defined a nation about as follows: "A group of people living within certain geographic boundaries and held together by a common antipathy for its neighbor nations." Though ironic and uncomplimentary to the human species, this definition, unfortunately, has a significant element of truth. To "antipathy for its neighbor" may be added "love of itself."

[17] Cf. Pintner, R., *op. cit.*, chap. 21.

tive countries.[18] In fact, in the light of more recent data some of the earlier advocates of the doctrine of "national-racial" superiority have appreciably modified their views.

In this country one study, among others, revealed no appreciable differences in intelligence ratings when about 2600 school children were divided into "racial" groups on the basis of physical criteria commonly used for such classification.[19] On the other hand, when the several *nationalities* included in each "racial" group were considered, differences in level were found. These results indicate that mental abilities, as measured, are not influenced by membership in one or another of the "racial" groups, but rather by differences in the environments of national groups: social, cultural, economic, educational.

Perhaps the most convincing investigation in this field was made in Europe.[20] Children were tested in Paris, Hamburg, and Rome, and in rural communities of France, Germany, and Italy. The results show unequivocally that differences in mental ability are appreciable when the children are grouped according to environment—city or rural—but not when the grouping is made according to "racial" membership as inferred from the physical characteristics (such as shape of head, color of hair, color of eyes, complexion) held by some to be typical of the several "races." This study, therefore, provides further evidence in support of the view that differences in mentality are products of environmental conditions, but not of "racial" membership.

The educational implications are clear. Since there is considerable overlapping of groups in respect to mental capacity, and since differences *within* any one group are vastly greater and more significant than those now existing

18 Bagley, W. C., *Determinism in Education*, Baltimore, Warwick and York, 1925.

19 Hirsch, N. D. M., *A Study of Natio-Racial Mental Differences*, Worcester, Genetic Psychology Monographs, vol. 1, nos. 3 and 4, 1926.

20 Klineberg, O., *A Study of Psychological Differences between Racial and National Groups in Europe*, New York, Archives of Psychology, no. 132, 1931.

between national and "racial" classifications, individuality once more asserts itself; and educational guidance becomes a matter of the particular individual under consideration, as an individual. For superior, average, and inferior mentalities have been found and will continue to occur in all groups.

Effect of Training upon Individual Differences. It is relevant here to point out the effect of identical training upon performances of different persons. Individual differences in abilities can be known only through their various manifestations, the amount of variation being determined by measurement or some other form of evaluation. Obviously, education and environment are accountable in part for variations in proficiency; hence it is important to know what effect identical training will have upon performance.

In general, it has been found that less able persons gain more in proportion to their initial performances than do the more able. In that respect, then, it would seem that differences are reduced, since the results indicate greater efficacy of training in the case of initially poor abilities. On the other hand, although relative differences are reduced, *absolute* differences often are increased.[21]

It is impossible to say at present which of these results is the more important. But educationally and psychologically it is most significant to know that initially poor individuals tend to make the greater relative gains, and that even those in the top ranks make very significant progress under training. The outstanding fact is the universal and marked improvement achieved under systematic and equalized training.

These experiments emphasize the importance of education, in the broadest sense, in the determination of differences in performance so often attributed to "pure" innate variations. Intelligence tests are measures of certain kinds

[21] Cf. Reed, H. B., *Influence of Training on Changes in Variability in Achievement*, Princeton, Psychological Monographs, no. 185, 1931.

of performance. Hence, if the results they reveal in regard to individual differences in intelligence are to be properly understood, it is necessary to take account of variations in opportunities for mental nurture as well as differences in genetic constitution. Furthermore, if one grants the desirability of promoting the knowledge and skills which are the subjects of instruction in the school, there can be no question as to the efficacy of education for nearly everyone. The relevancy of these findings to the nature-nurture problem and to the "national-racial" problem is obvious; as indeed it is to all aspects of the study of individual differences.

Differences in Mental Abilities Due to Sex. For centuries, and until relatively recent years, it was believed that woman is by nature intellectually inferior to man—a view probably held by some even today. This mistaken notion was bound to have its effect upon the kind and extent of education provided for girls and women, and upon women's actual achievements in all fields of activity. Consequently, failing to give weight to educational and social disadvantages forced upon girls and women, many maintained that individual differences in mental abilities were in part attributable to innate sex factors.

The notion of male superiority has been discredited so far as general intellectual ability is concerned. Numerous studies have shown that there are slight but unreliable differences in average IQs of school children.[32] Where the numbers of each sex are large enough to be representative, the average IQs for each sex are very close to the expected 100.

Measurements of specific traits, however, indicate that there are small but consistent and reliable sex differences.[33] Practically all results point to a small, consistent superiority

[32] Cf. Lincoln, E. A., *Sex Differences in the Growth of American School Children*, Baltimore, Warwick and York, 1927; and St. John, C. W., *Educational Achievement in Relation to Intelligence*, Cambridge, Harvard University Press, 1930.

[33] Cf. Freeman, F. S., *op. cit.*, pp. 200 ff.

of females over males in linguistic ability. In number concepts and arithmetical ability, including computation and reasoning, the weight of evidence is on the side of a small difference in favor of the male group, though the results are not so unequivocal as in the case of language. In tests of memory, girls as a group appear to be somewhat superior to boys. In manual performance and in mechanical aptitude males in general surpass females.

We hasten to add that sex differences in the foregoing traits apply to *group averages*. There is in each of these, particularly in the first three, great overlapping of the distributions of the two sexes. Wherever overlapping is found, it is simply impossible by virtue of group membership alone to characterize an individual with respect to a given trait without ascertaining that specific person's degree of the trait.

Differences in Physical Traits Due to Sex. This category of sex differences is more important than differences in mental abilities due to sex membership. Structural differences between male and female are not of much consequence before puberty; what few there are being in favor of girls. The rate of physical development for girls as a group is more rapid than the rate for boys as a group, the former reaching physical maturity somewhat earlier. In a study of boys and girls between six and seventeen years of age, the girls at each age had attained a higher percentage of their adult height and weight than had the boys. Between the ages of 10 and 14, girls as a group were superior in absolute height; while between 10 and 15 they were superior in absolute weight. Reproductive maturity, some investigations show, is reached by girls, on the average, one year ahead of boys. Other investigations indicate that reproductive maturity is reached at about the same age. The conflict is due mainly to the relative uncertainty of criteria in the case of boys.

Ultimate adult status, however, involves considerable qualitative differentiation in physique between the sexes, and this comes during adolescence in which the secondary

sex characters are established and emphasized. With the commencement of gonadal functioning, all the glandular secretions become influenced and are responsible for sex differences in shape, distribution of body and facial hair, and deepening of the male voice. During adolescence, also, marked differences in musculature appear. As a result, even when matched in size with girls, boys, as a group, can run faster, punch harder, and excel in any activity which requires a large output of concentrated energy. Girls, on their side, deviate from boys during adolescence with respect to physical peculiarities attending menstruation and childbearing. Thus, in this category, differences between mature members of both sexes are largely matters of physical power and periodic disabilities which handicap women.

Allotment of distinct occupations in social groups is based only in part upon sex differences in physical strength or speed, as in hunting, warfare, and the heavy trades. Beyond these, occupational distinctions are conventional and arbitrary. But once such distinctions become established in a society, the effect of environment becomes fundamentally diverse for the two sexes at an early age; and under such diverse conditions, pronounced differences in mental traits will arise as a result. In this manner, tradition will prescribe diverse occupations which become habitually accepted and regarded as a part of "nature" for want of knowledge of alternative possibilities. Such tradition then becomes informally and powerfully effective and more or less codified. However, even in the matter of strenuous physical exertion, there is no universal biological basis for limiting an occupation to one sex, so far as the *individual* is concerned. For although women are generally smaller and weaker than men, there are numerous individual women who are larger and stronger than the average man, just as there are numerous men who are smaller and weaker than the average woman. In Japan, women work as navvies and longshoremen; in Victorian England, women worked as coal miners;

in all countries with a peasant tradition, women have conventionally performed heavy labor. Consequently, work depending upon physique could more reasonably be placed upon an individual basis, rather than one of sex *per se*. Yet, since physical differences in strength, speed, and periodic disability do exist between the sexes, *as groups*, tradition has prescribed and denied certain activities and occupations for each sex, thereby creating significant environmental differences which produce psychological differences.

Sex Differences Due to Cultural Traditions. The traditions of a culture are the most powerful influences that determine the distinctions between the tasks allotted to the sexes, and hence contribute to certain manifested differences in behavior and abilities. These distinctions are constantly impressed upon everyone as part of an unquestioned social atmosphere, from the play activities of early childhood through adulthood, as well as through deliberate education. This is true of primitive groups whose distinctions are even more rigid than those in our own culture. The South African Zulu practices the custom of forbidding women all contact with cattle; the female may not come near the cattle pen, lest the animals suffer from it. Therefore, only men do the milking. Among the Bolivian Yuracare Indians all, regardless of sex, fish, cultivate the soil, and beat out bark for cloth. But the manufacture of weapons, baskets, houses, and canoes is reserved to men; while cooking, sewing, spinning, weaving, pottery-making, fish-net weaving, carrying of firewood and water, and service as porters on the march are prescribed for women. Samoan men do the cooking; while Hopi men do the spinning and weaving. Yet among the neighboring Navaho all parts of cloth making are left to women. In Nigeria, women spin and men weave. In the Congo, men carry the manufacture of cloth to the point of applying the final figured design which is added by the women. The tanning of leather is a purely masculine task among most groups, but with the Plains Indians of North

America it is within the feminine sphere. In the Trobriand Islands men assume the job of dry-nursing infants.[24] From these illustrations it is clear that where no primary or secondary sex traits are involved, the division of occupations on the basis of sex—and hence the development of certain abilities—is a matter of convention, not of "natural" sex differences. If the basis for sex distinction in occupations were biologically more genuine than mere convention, we should expect closer universal conformity in the pattern of male and female behavior than has been discovered.

The above facts concerning primitives are in accord with similar practices in our own civilized groups. What started as purely arbitrary distinctions came by tradition to be regarded as belonging to the natural order of things because the plausibility of an alternative is unknown. Until recently, we thought it unseemly that females should smoke or engage in sports; or that they should desire to practice medicine, law, or politics; or that they should even aspire to the vote, which is still denied them in some countries. There are many today who think of female professors, physicians, preachers, and scientists much as Samuel Johnson thought of the female preacher who had been reported to him: namely, not that it was remarkable for her to do so well, but that it was remarkable for her to have done anything at all along that line. His unflattering comment was amplified with the observation that one is always surprised to see a dog walk on his hind legs, even if he does it badly. It was not until 1920 that women could become chartered accountants or members of the bar in England. The reception which a husky girl would get if she presented herself for apprenticeship in carpentry or plumbing can be easily and vividly imagined.[25]

[24] Cf. Lowie, R. H., *Are We Civilized?*, New York, Harcourt, Brace, 1929, pp. 108-10.

[25] The lone girl student in a college of mechanical engineering was called "Slide-rule Sue," being also the object of considerable interest and comment among the student body.

We have noted the importance of environmental opportunities in general, and schooling in particular, in the development of intelligence. If females were less capable in *manifested* intelligence, as they undoubtedly have been, this inferiority was due to environmental deficiencies, but not to anything inherent in their sex. 1

Secondary education was not available to girls in this country until the late eighteenth century; but it was not until the middle of the nineteenth century that girls' opportunities for secondary education were in any sense general. Even so, education of the female mind was still in disrepute; for in these early alleged secondary schools for girls the actual offerings were intellectually inferior to those in the boys' schools; girls were to be educated for the "polite female accomplishments" (determined by convention), while boys were receiving the best materials then available.

As might be expected, women's opportunities for higher education were fewer and slower in coming than were those for secondary. The significant movement in the direction of higher education for women did not come until after the Civil War; and it was slow in gaining momentum. The even greater struggle for professional education and recognition has already been noted.

Summary. The large central groups of both sexes coincide in general intelligence. The small differences noted in language, number, mechanical, and memory ability are too slight to justify distinctions in allotment of tasks or in educational provisions. Such slight group differences do not provide a reason for neglecting the much larger differences among individuals of *each* sex. Sex, as such, plays no part in the ability to learn; and this, after all, is the core of the question of sex distinctions. ?

Differences Due to Age. It is axiomatic that an individual's mental capacities increase as he grows older, until the age of maximum mental capacity is reached. It will be recalled that the average age at which the maximum is attained

has not yet been finally determined. Some psychologists maintain it is in the neighborhood of 15 or 16; others place it closer to 18; whereas there is reason to believe it might actually be about 20.)

Although the age of maximum mental capacity is of theoretical and practical significance, it is not of importance for our topic at the moment. (What is important for us at this

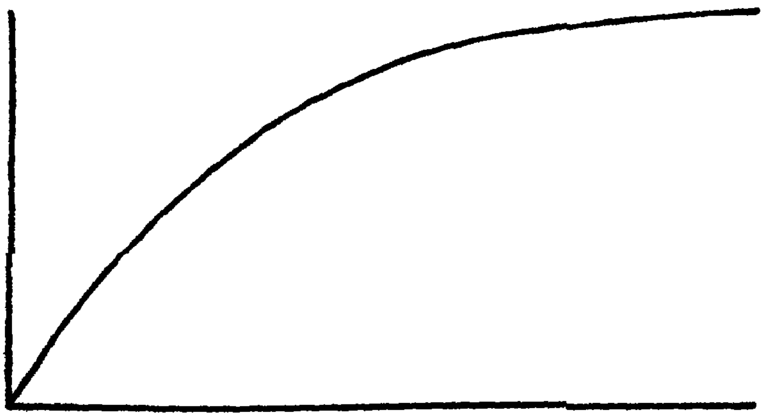

FIG. 34. Relation of altitude of intellect to age in years, 0 to 20.

point is the fact that *in general* the growth of intelligence is regular and continuous until the maximum is reached,) as shown in Figure 34. Like so many other problems in the relatively young science of psychology, the particular *form* of the growth curve is somewhat in dispute. However, the curve here reproduced is the one most widely accepted. Furthermore, regardless of the form of the curve, certain other conclusions do emerge from which very few, if any, would dissent. (First, mental growth is neither irregular nor haphazard; instead it is regular and continuous until the level of maturity is attained. In the second place—in spite of some uncertainties regarding slow phases and rapid phases—it is certain that the first ten years of life constitute a period of the most rapid growth, great in extent and importance. Third, although mental growth does indeed continue beyond

the age of ten, it does so at a gradually diminishing rate, until adult level is reached. Fourth, for individuals at different levels of ability ("normal," superior, inferior) the growth curves are essentially similar.[26] Finally, since typically there is no meeting, nor crossing and recrossing of the curves representing the several ability levels, differences are rather well maintained; that is, the superior group do not, with age, drop to the average; the inferior do not catch up with the average; and the average are not likely to become inferior or superior.

The problem of constancy of relative position in mental status has been studied in terms of intelligence quotient constancy. The maintenance of relative rank is very marked but not universal.[27] Correlational studies, using two or more

[26] A very recent study appears to cast some doubt on this point. See Freeman, F. N., and Flory, C. D., *Growth in Intellectual Ability as Measured by Repeated Tests*, Washington, Monograph of the Society for Research in Child Development, vol. 2, no. 2, 1937. These authors say: "The salient facts are that the brighter children show an accelerated rate of intellectual growth in later childhood and that their rate of growth slows down somewhat in middle or later adolescence, whereas the duller children exhibit an almost constant rate of growth throughout the entire period. The curve of the middle group is intermediate in its form and position" (p. 91). First, it must be noted that their curves are for a group of children retested *between the ages of 11 and 16;* that is, *after* the period of most rapid growth. Thus, the growth curves prior to the age of 11, and during the period of greatest development, could still be of uniform type. Also, it is not improbable that the differences noted above for the several ability levels are the result only of different rates of deceleration following the period of most growth. If this should be the case, then even Freeman and Flory's findings would not invalidate the view that the curves for the several ability levels are essentially similar. Finally, their subjects did not include an adequate group of mentally dull or inferior; for the lowest IQ was approximately 80. The mean for all subjects was 115.35, the standard deviation, 13.81.

[27] Freeman and Flory, *op. cit.*, p. 90, state that individual differences in the rate and form of the growth curve ". . . cannot reasonably be ascribed wholly or even mainly to accidental causes, since many of them exhibit a consistency which rules out such an interpretation. They reveal real differences in intellectual development. Such differences place a limit on the accuracy of prediction of the intellectual growth of an individual, particularly over a long period of time. . . . A comprehensive and accurate statement concerning the rate of intellectual growth of different individuals is necessarily a qualified statement. Neither the simple statement that the growth curves of different individuals resemble each other and that the growth of an individual is predictable nor the statement that the growth curves of dif-

sets of test results for the same group of subjects, the retests having been given at intervals varying from several hours to ten years, have yielded coefficients between +.75 and +.95, the average being about +.87. These high coefficients mean that children tend, by and large, to maintain their relative positions with respect to the whole group. In a few instances there will be serious discrepancies, but the causes cannot be known until each case is examined. Nor can we predict who will fail to show constancy of mental growth. Thus, individuality once more asserts itself, though a generalization of constancy is warranted for the group; and in this instance that means for most individuals by far.

Individual differences in rate of mental growth and in the level reached manifest themselves in infancy. Mental growth during infancy and very early childhood has been shown to conform to a certain order of succession, or sequence. The differences during this period are, therefore, not of pattern and organization but rather of the time required to pass through the early stages and to reach higher levels of richer behavior and experience. These facts are important and interesting in themselves. But individual differences in infancy and very early childhood assume added significance if they are reliable indicators of future rates and levels of mental development. This assumes, as does the preceding discussion, that the factors essential in mental growth remain reasonably constant during the early and most important period of development, and that no exceptional conditions intervene.

Because of difficulties in devising proper tests for this earliest life period and because of difficulties of statistical treatment, the predictive value of test ratings before the age of about two or two and a half years is still in question. But

ferent individuals are diverse and the growth of an individual is not predictable covers the case. . . . Growth curves do exhibit a certain degree of similarity, but by no means complete uniformity or even a close approach to it. The growth of an individual is predictable, but the prediction is a matter of probability and not of certainty.

there is reason to believe that these test results do have predictive value,[28] particularly in the identification of the very much accelerated or very much retarded child.

The Period of Decline Due to Age. It is a matter of common observation that late in life persons suffer a decline in mental abilities. But until recently little was known re-

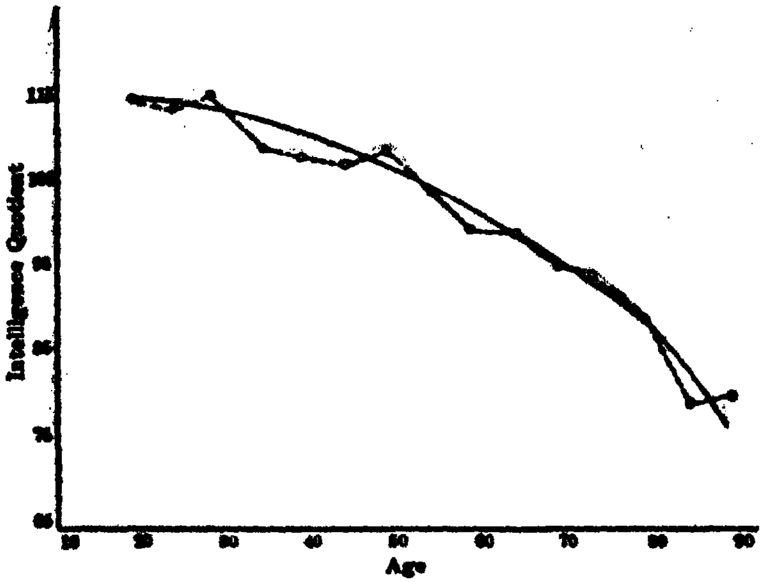

FIG. 35. Decline in IQ after maturity.

garding the nature of decline or its individual variations. One detailed study, among several others, has revealed that decline proceeds gradually at first, increasing in rate with age, especially after sixty.[29] This is shown in Figure 35.

The noteworthy fact for our purposes is this: although practically all persons show an appreciable decline in mental level in late maturity, they reveal a strong tendency to maintain their relative positions with respect to their groups until close to the end of the life span.

[28] Cf. Gesell, A., *Infancy and Human Growth*, New York, Macmillan, 1928.

[29] Miles, C. C., and W. R., "Correlation of Intelligence Scores and Chronological Age from Early to Late Maturity," *American Journal of Psychology*, vol. 44, 1932, 44-78.

Educational Significance of Mental Development. Viewing all available data on mental development, it appears that individual differences in abilities are not the results of haphazard or capricious growth. Provided there are no untoward circumstances or significant changes in environment during the growth period, an individual tends to maintain his position of relative mediocrity, superiority, or inferiority as determined by the integral character of his genetic constitution and the conditions of his development. For education this is a significant fact, since it means that the human materials of the educative process are not shifting and unstable.

Educational Implications of Individual Differences. We must conceive of the child's education as beginning no later than at birth. Education is more than formal schooling, which is but a part of education, and sometimes a small one. Since a person's abilities, as well as his traits of personality and physique, are the products of an integration of inherited potentialities and environmental forces, the importance of an optimal environment for mental growth is apparent. The significance of favorable conditions very early in the child's life has been demonstrated by several recent studies in which it was shown that children attending preschool institutions make advances in intelligence which are lasting and real.[20]

Educational forces continue to exert their influence throughout the entire developmental period, as shown, for example, by the canal-boat children. Therefore we must regard the duration, quality, and intensity of educational forces as influences of the first order in the production of individual differences in mental abilities. This does not mean, of course, that equalized opportunity for mental nurture will make all children equally competent, for we must still reckon with variations in genetic constitution. But it

[20] Wellman, B. L., "Growth in Intelligence under Differing School Environments," *Journal of Experimental Education*, vol. 3, 1934, 59-83; "The Effect of Pre-School Attendance upon the IQ," *Ibid.*, vol. 1, 1932, 48-69.

does mean that for the full realization of every individual's capabilities, it is essential that an optimal environment be provided. It should therefore be clear that many of the notions with regard to the inherent character of racial, national, and occupational differences in intellect are without scientific support, for the good and obvious reason that environments are not equalized, and too few of them are optimal.

Since it has been shown that all levels of mental ability are found in all social and economic groups, although in varying proportions, the education of any child becomes an individual matter. For education of specific kinds and degrees cannot be prescribed on the basis of social or economic membership of a child's family.

Nor should an educational program be limited by one's sex-membership, so far as concerns mental abilities as such, in spite of minor differences noted with respect to language, arithmetic, and memory. The differences between the sexes in interests and aptitudes are not the results of sex-linked psychological traits. They are to be attributed rather to social forces which, operating from very early childhood, produce true differences in the abilities of the end-products. Sexual differentiation in education in certain fields may be desirable on the basis of social factors and, in some instances, physique (strength and periodic disability). The soundest procedure, however, is to educate an individual in a manner consistent with his or her abilities, interests, and traits of personality, minimizing the sex factor as such.

School Problems Due to Individual Differences. By the time children enter the first grade, differences in abilities are already marked, and absolute differences become more pronounced as they progress. Whatever the reasons for these diversities, the fact is that the school should deal with them by means of differentiated curricula and individualized instruction so far as necessary and feasible.

Because abilities in school subjects are well correlated, a

pupil, other things being equal, should not vary widely and capriciously in achievement in the several subjects, although uniformity need not be expected. At the same time, there are some children whose abilities are rather irregular, due to genetic or physical factors, habits, or environmental background. Ideally, then, it is the school's responsibility to find not only each child's general intellectual level, but to discover his special aptitudes or weaknesses, if he has any. This may be accomplished through careful observations by teachers, educational tests (achievement, diagnostic, prognostic), or special clinical examinations, or any combination of these. Diagnostic tests may serve to discover difficulties and aptitudes in special fields—such as arithmetic, reading, music—as well as to determine a general educational program.

Provision for individual differences should not end with differentiated curricula, for within the same subject and course of study there are appreciable differences in aptitude. This is particularly true in the universals or constants which are prescribed for practically all pupils. It is necessary, therefore, to provide means of instruction which will meet pupils' special needs not only with respect to the fields of study, but also as regards rate of progress, extensity, and intensity of study within these fields. A common method of satisfying these latter conditions is to classify or group pupils into sections on the basis of ability, such as superior, average, inferior, with gradations between these, where facilities permit. Though important, such grouping is only a first step which makes it easier to initiate instruction that comes closer to meeting individual needs.

Where ability groupings have been wisely made, both subject matter and methods of instruction being adapted to their needs, the psychological and educational advantages have been impressive enough to commend the practice to a large majority of educators who have had experience with it. Whatever the details of the particular scheme may be, differentiated instruction should attempt to provide for diversi-

ties of ability, interest, purpose, and other complicating factors of individuality, such as temperament and physical abnormalities. The alternative, mass instruction, fails to foster and conserve superior abilities and special talent, just as it fails to develop the limited capacities of inferior children.

Although it is a major task of the school to discern and cultivate superior and creative minds, and to bring the inferior to their maximum level of effectiveness, it is nevertheless true that the many individuals compassed within the "average" group also present their own idiosyncrasies. In a literal sense, everyone is exceptional; for although classifications are possible with respect to a given aspect of individuality, and although there is a concentration of cases about the central tendency in a given trait, it is the integration of numerous and varied characteristics that gives a person his individuality. With the exception of identical twins, the probability is extremely remote that any two persons will be alike in all respects; and it has been demonstrated that not even identical twins are necessarily so. The psychological fallacy of mass instruction is, therefore, apparent.

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Chapter XVIII

POINTS OF VIEW IN PSYCHOLOGY

Introduction. Although psychologists agree that their science should be devoted to experimentally established facts, they differ in respect to the theoretical organization and interpretation of their materials. They differ also regarding the subject matter to be investigated and the methods to be employed.

Among the "schools" of psychology, there are, principally, the existential (or structural), the functional, the behavioristic, the Gestalt, the hormic (or purposive), the organismic, and the psychoanalytic—all of which have elements more or less in common. The existence of these "schools" and points of view cannot be taken as evidence of a science suffering from family strife. The theoretical and methodological differences must be attributed to the relative youth of the science, the experimenters and theorists of which have yet to resolve many doubts and problems and to fill the gaps in their incomplete information. The systems, or schools, of psychology are, however, not the scientific facts themselves. They are instead the hypotheses by and through which scientific information is obtained, and with which scientific data are interpreted.

The nature of psychology and psychologists is further complicated by the fact that there are not only systems but "fields" as well; some of which are the older (and hence more "respectable") theoretical, and "purely scientific"; whereas others are the newer realms (and hence often looked upon askance by the more orthodox psychologists) usually investigated and developed with a practical or useful aim in view.

In this latter class belong such fields as mental testing, personality measurement, personnel psychology, psychology of the abnormal, psychology of business and industry, the study of individual differences, educational psychology, child psychology, psychology of adolescence, and others. While it is true that in every one of these newer fields the demands of "pure" science can be met, it is a fact nevertheless that most of the psychologists working in them have utilitarian interests; since through the acquisition of a body of facts and principles they wish to bring about changes in certain forms of behavior (from good eating habits in children to the weakening of sales resistance in adults) and to relieve human difficulties.

To some of the older "strictly scientific" psychologists such aims as these have no place in a science; for, they say, pure science should not be concerned with utility and values. The business of science, they hold, is to discover the facts of its subject matter, to understand those facts, and to formulate them into generalizations. These more orthodox psychologists, therefore, prefer not to call the newer fields science, nor the workers therein scientists. Instead, they employ the terms technology and technologists, respectively. Thus, these more orthodox psychologists are critical of the newer developments on two grounds: first, they question the propriety of calling them psychology; and second, they would make a sharp distinction between science and technology.

We shall see, however, that at about the turn of the century, and even earlier, an increasing number of psychologists refused to endorse this view. Among those not in agreement may be mentioned James, who adhered to no school but was concerned in his psychology with concrete experience and behavior; Hall, whose interest centered in genetic psychology and the psychological phenomena of adolescence, but whose interests and activities ranged over a wide field; Cattell, who had begun to work on individual differences and mental measurements; Angell, who was one of the early functional-

ists (discussed in this chapter); and Woodworth, who early was interested in the nature of behavior and later presented a detailed statement of dynamic psychology (also discussed in this chapter).

It is not our purpose to enter into a discussion of the merits or weaknesses of a rigid distinction between science and technology.[1] We wish only to acquaint the student with the existence of this conflict in point of view. We must add, however, that there are many contemporary psychologists who do not accept the sharp distinction made between science and technology, regarding it as artificial; and who hold, also, that a science devoid of individual and social aims and values is in danger of becoming sterile. Finally, the remarkable growth of interest, activity, and volume of work in psychology (perhaps too rapid a growth) is in large part attributable to its emphasis (particularly in the United States and England) upon its utility and individual and social values in effecting improved methods and behavior in a variety of directions.

In the remainder of this chapter, we shall only present very briefly the features of each of the principal "schools" of psychology; in the course of this presentation some of the differences in points of view regarding subject matter, method, and purpose will be apparent.

Introspection and Existentialism. Existential psychology, which is synonymous with structural, is a psychological method and point of view which investigates and describes the composition of mental states and conscious experiences. In effect, this point of view limits the subject matter of psychology to the sensory and readily perceived aspects of experience. The method it employs is introspection, which is the subjective observation of one's own self during or after the experience under investigation. The individual, called the observer, is placed in an experimental situation, sub-

[1] For a brief discussion of this problem, see Weld, H. P., *Psychology as Science*, Holt, New York, 1928, chap. 4.

jected to certain stimuli, and asked to report his experiences in accordance with set instructions received from the experimenter.

For example, this psychology has been greatly concerned with the analysis of sensory experiences into their elementary sensations; that is, the elements out of which experiences are composed. What a person ordinarily describes by "common sense" methods as the facts of experience, says the existentialist, is a blend of numerous elements. But the *trained observer*, the person who has learned to analyze experiences into their constituents, is able to free himself from "common sense" impressions of blends and to observe, instead, the basic, elementary sensations. And, says the existentialist, it is such observation and these elements that are the true methods and subject matter of psychology.

By this method and point of view, the sense impressions known as touch, or the skin senses, have been analyzed into the following constituent elements: cold, warmth, pressure, and pain. All other tactual impressions such as size, shape, texture, roughness, dryness, etc., are said to be blends of these four, plus kinesthesia (the sensations attending movements of any members of the body, and arising from stimulation within the muscular tissues, joints, and tendons). Similarly, taste has been analyzed into sweet, sour, bitter, salty; all other taste impressions are blends of these with odor—touch and temperature also entering to give the experiencer a unitary impression. Smell, co-operating with taste in giving us our experiences, has been analyzed into the following elements: foul, flowery, fruity, spicy, burnt, and resinous. All odor impressions, therefore, are said to be combinations and variations of these. Vision, it has been found, has six elementary sensations: namely, white, black, yellow, red, green, and blue. These, of course, are capable of giving an indefinite number of blends. In hearing, it appears, the only elements are pitches. But each pitch has

the further distinguishable attributes of volume, loudness, duration, and brightness.

In order that the sensory elements, listed above, may be observed, it is necessary that the individual making the introspection should disregard meanings and values. That is, he is presumably not at all concerned with the practical significance of his impressions. He is concerned, instead, only with reporting the impressions themselves freed of all complicating factors. To illustrate: whereas ordinarily one might say, "This is a clear, bright day," the observer, from the existential viewpoint, would report, "My visual field is one of blue, with a few small irregular areas of gray and green," or something similar. Or, again, instead of saying, I smell an onion, the observer should describe the particular impressions he is receiving, but not the object which they indicate.

Thus, the existentialist investigates the *content* of experience; he is not concerned with the objects, meanings, and values to which the impressions refer. According to this view, therefore, the aim of psychology is to describe experiences in and for themselves. Experiences are "existences"; hence the name "existentialism."

But not all introspective psychology is strictly existential. Some psychologists, contrary to the existentialists, have insisted that the method and subject matter of psychology should include reports of *performance* as well as experience. In other words, the individual observer reports not only his impressions but also as much as possible of the entire subjective situation and process, We may take the study of memory as a case in point. Now, memory processes can be and are measured objectively; as, for example, in measuring the rate of memorizing, the rate of forgetting, the rate of re-memorizing, the effects of various conditions upon memorizing and forgetting, etc. In addition to these measurable aspects, however, it is possible through introspection by the memorizer to ascertain what his experiences and mental

processes were in the course of his efforts. Such introspection has revealed that the individual in memorizing looks for and makes certain rhythms, groupings, and pairings; he tries to discover similarities, differences, and meanings. Reports of these are introspections of performance, or behavior.

Understanding of the mental processes in other kinds of behavior has likewise been enhanced through the use of introspection, in such diverse activities as in reaching a judgment or in the immediate response to a stimulus in which the elapsed time between stimulation and response is measured (the reaction-time experiment). In a situation requiring judgment, it has been reported, the individual experiences a "conscious attitude" which may be one of hesitancy, doubt, confidence, and the like. In the reaction-time experiment, it has been discovered through introspection that the individual "prepares for action" before the stimulus is given and that the response is immediate and automatic, there being ordinarily no conscious processes between stimulus and response.

It is thus clear that the psychological method of introspection is capable of illuminating a variety of activities and may be used to describe mental processes and performances, as well as to reveal the elements of experience. But the existentialists, notably E. B. Titchener, would restrict the method of introspection, and indeed all psychology, to the discovery and description of these elements. The subsequent pages of this chapter will show what introspection fails to reveal.

Functional Psychology. Functional psychology, though not rejecting consciousness, regards mental phenomena as activities or processes rather than as experiences. The functional standpoint emphasizes the utility of mental phenomena to the organism in its adjustments to the environment. Functional psychology, therefore, is interested in studying mental processes and the organism's activities in their customary settings. In short, functionalism considers the organism as a going concern with some aim and meaning. From

this point of view, the psychologist asks what the process or activity is for and how it works. He thus investigates both the antecedents and the consequences of the mental phenomenon or activity under consideration. He takes into account the entire complex setting in which the phenomenon or activity occurs; he regards the entire setting as a continuous and unified whole. Otherwise, he maintains, mental processes and activities cannot be understood, nor their significance grasped. Activity is considered as a whole and as directed toward a goal. Functional psychology, it is clear then, goes far beyond the severely circumscribed and strictly non-utilitarian subject matter of existential psychology. The latter is interested only in the analysis of conscious experiences into their elements; the former is interested in mental phenomena and activities for their utility and practical consequences in the organism's efforts to adjust to its environment. Functional psychology, therefore, readily entered the applied fields.[8] And though functionalists use introspection, they place their emphasis upon outward behavior; that is, they emphasize objective methods.

Carr, who writes from the functional standpoint, states that psychology is the study of mental activity and that mental activity is concerned with "the acquisition, fixation, retention, organization, and evaluation of experiences, and their subsequent utilization in the guidance of conduct." Since adaptation of activity is the subject matter of psychological study, Carr analyzes the characteristics of an adaptive act into "a motivating stimulus, a sensory situation, and a response that alters that situation in a way that satisfies the motivating conditions." These three aspects are bound up or blended into a complex but single continuous course of activity in which there is interplay between motive, sensory

[8] Among the earliest advocates of functionalism was John Dewey who applied its principles to education. It is easy to see how the functional view lends itself to educational problems. See Dewey's *How We Think*, Boston, Heath, 1933 (revised edition); and *Human Nature and Conduct*, New York, Holt, 1922.

stimulation, and response (adaptation). This view thus stresses the point that psychological processes and activities are functions of living individuals who are constantly making more or less adequate adjustments to the environments in which they find themselves. Accordingly, it is the business of psychology to find out what the processes and activities are, what immediate ends they serve (adjustment), how and under what conditions they work (relation to their settings). This approach in psychology is now so widespread that functionalism, as a school, has practically lost its identity.

Behaviorism. Behavioristic psychology deals only with phenomena which are observable objectively, without reference to consciousness; that is, observable by an individual other than the subject himself, thus excluding the treatment of conscious experiences. Behavioristic psychology appeared as a revolt against the very narrow definition of psychology as the study of nothing but the elements of conscious experience. Behaviorists maintained that other psychologists were occupying themselves with "intangibles" and "unapproachables." They reject consciousness and experiences as suitable subjects of psychological or scientific study; for these, they maintain, are intangible and are not capable of scientific verification. They reject, also, such older and orthodox psychological methods and concepts as introspection, mental states, mind, mental content, will, imagery, thinking, judging, and the like. In fact, they reject the concept of "sensation" (such as a visual or auditory sensation), employing, instead, the terms "response to light," "auditory response," etc. Behaviorists hold, instead, that psychology must be purely objective and must employ objective methods exclusively; and they would make psychology a natural science, like biology. For behaviorists, even functionalism which stresses activity, does not go far enough in objectivity and compromises too much.

Whereas the more orthodox psychology was concerned with analyses of experience and consciousness for their own

sake, behaviorism was to be concerned with gaining accurate knowledge of how living organisms (including man) made adjustments to their environments and with the stimuli evoking this behavior. Behaviorism, thus, was to have practical significance, for according to this view, psychologists should set about learning the methods whereby behavior can be predicted; in short, the practical management of human affairs. Behaviorism, therefore, declared itself to be more than just a scientific method in psychology. It took a wide range of activity as its subject matter; and it was also to be practical and applied.

Behaviorists were not original in demanding that psychology should study a wide range of activity, that it should be objective, and that it should contribute to the control and direction of human behavior. Behaviorism was preceded, for example, by Lloyd-Morgan who worked to place animal psychology on an experimental rather than an anecdotal plane; by Thorndike who, beginning in 1896, gave emphasis to animal psychology and devised objective experiments; by Cattell who insisted that psychology must study behavior in order to assist in the practical matter of human control; by McDougall and others who were revising the definition of psychology to read as "the science of behavior," relying upon objective methods. These forerunners of behaviorism, however, did not go to the extreme of throwing overboard all previous psychological concepts and methods, like consciousness, images, sensation, etc.

The founder of the school of behaviorism was J. B. Watson, who had worked principally in animal psychology. Animals were favored as experimental subjects because their environments and experimental conditions could be regulated: as in diet, rest, activity, and general living conditions. He insisted, nevertheless, that the methods of animal psychology could be legitimately and profitably applied to the study of human behavior if the emphasis were put upon

activity and objective methods of experimentation and observation.

The two sources that probably contributed most to the behavioristic movement, as it was announced in 1912, were Thorndike's experiments in animal learning and the experiments of the Russians Pavlov and Bechterev on the "conditioned reflex." Thorndike concluded from his experiments that animals learn by doing, by a process of trial and error. He held that human learning is also to be explained in the same way—from a motor skill such as playing a game (say, baseball) to ideational thinking. In fact, he urged, man derives his ideas, concepts, and thinking from activity, from *doing;* but apparently not from having insights, nor from reflection.

Thorndike consequently formulated two laws of learning, the first being the Law of Exercise. According to this law, use strengthens a given response, whereas disuse weakens it. The second, the Law of Effect, states that successful or satisfying responses are stamped in, whereas unsuccessful or annoying responses are eliminated. Thus learning is a matter of frequency of activity and the amount of satisfaction one gets out of the activity, the two working together.

But Thorndike did not leave the matter there. He stated that learning involves the establishment of bonds in the nervous system between incoming (afferent) nerves which are excited by the stimuli and the motor (efferent) nerves which arouse the appropriate muscles and thus give the needed motor response. It is clear, therefore, that Thorndike was not only defining learning in terms of activity, but he was also postulating a physical basis for such learning. The nature of the physical basis, it should be noted, is quite hypothetical; for though the nervous system and other parts of the body are involved, it is not known even today just how they are organized nor exactly how they work.

Pavlov, a physiologist, and Bechterev, a neurologist, working independently, discovered what is now known as the

"conditioned reflex." A conditioned reflex is a response that has become attached to a substitute for the original stimulus which evoked this response. Or, to put it otherwise, a stimulus that was ineffective or indifferent to begin with has become, by the process of conditioning, attached to a given response. Pavlov, who worked with animals, and Bechterev, who worked with both human and animal subjects, observed the same phenomenon. Although these men were not psychologists, and although their experiments were not directed toward the solution of psychological problems, their methods and results were cordially, in fact eagerly, received by the behaviorists who proceeded to apply the conditioned reflex technique and principles to the study and interpretation of all behavior and all learning.

Thorndike's animal experiments and laws of learning, it appears, stimulated Watson and others to work in the same direction. But Watson rejected the Law of Effect because it smacked of consciousness and experience, neither of which he could accept. Consequently he was left with the Law of Exercise (which he called the Law of Frequency), to which was added the Law of Recency. According to the latter, the response most recently given to a certain stimulus will again be evoked upon a subsequent presentation of that stimulus, other things being equal. Watson also purported to prove, but erroneously, that the correct responses, by virtue of merely being correct, were repeated more frequently in learning than the incorrect ones; and hence this supposedly reinforced the frequency law.

But it was the conditioned reflex technique and explanation that was accepted by behaviorism as fundamental in psychological method and theory. Consequently, all behavior is regarded as sensory-motor, consisting of stimulus-response units, each of which begins with a stimulus to some sense organ and terminates in a muscular or glandular response, or in a combination of these. And by the process of conditioning, numerous and complex responses are pre-

sumably attached to a stimulus. All complicated systems of habits and motor skills are said to be built upon original random movements of trunk, arms, legs, hands, and fingers through the operations of frequency and recency. Similarly, what is ordinarily called memory is only a matter of stamping in responses by the conditioned reflex method, through frequency and recency. Thinking, also, is said to be nothing more than implicit, or inner, speech movements. Thinking is objective behavior, involving the substitution, by the conditioned response method, of symbols (words, numbers, and other signs) for original objects and events.

The behavioristic theory of learning, if correct, would be of far-reaching significance educationally. For it would require the practice of a decidedly mechanical method of instruction wherein frequency of repetition and recency of behavior would be the determinants of what one did or knew. It would mean that education is a matter only of habit formation whereby the individual is equipped to give a certain response to a certain stimulus.[3] In fact, Watson has stated that the stimulus-response technique and the conditioned reflex principle are the means of social and individual organization and reconstruction.[4]

Acceptance and advocacy of the conditioned reflex method and the stimulus-response principle quite naturally led to behaviorists taking definite positions in respect to other psychological questions. Notable among these is their complete rejection of all "instincts" and all inherited mental traits. According to this doctrine, then, practically all that a person is and does is a matter of learning by the method of conditioning. There are no innate behavior patterns. However, his studies of infants did lead Watson to state that there are three "native" emotional behavior patterns: namely, fear (in limited, specified situations), rage (in certain

[3] The reader may refer to the discussion of learning (pp. 260 ff.) for a criticism of this view.

[4] A view not held by non-behaviorists.

specified situations), and love (or, more appropriately, satisfaction and contentment in response to physical stimulation). All other emotional responses are regarded as being extensions to originally neutral objects formed by the process of stimulus-response learning. In this way behaviorists would account for the many expressions of fear, rage, and love, other than the few manifestations in infancy. In short, they maintain that, excepting the three aforementioned "native" emotional responses, the human individual inherits only his bodily structures and modes of operating. He inherits nothing else. All else is acquired by the stimulus-response method.

Behaviorism, in summary, was a revolt against the orthodox subject matter and methods of psychology; it insisted that psychology must use objective methods, meaning methods whereby activity can be observed and measured by someone other than the experiencer; it rejects intangibles and non-measurables which are not capable of verification by objective methods; it takes all realms of behavior as its subject matter, for it is concerned with the control and direction of human behavior; it puts practically full emphasis upon training as the determinant of individuality; it maintains that the stimulus-response and the conditioned reflex principles furnish the method and the explanation of all learning and behavior; it therefore holds that behaviorism offers a relatively simple and universal procedure whereby psychology may become not only a natural science but a practical one, valuable and useful in the solution of human individual and social problems.[4]

Gestalt Psychology. *Gestalt* is a German word variously translated into English as pattern, figure, configuration, and

[4] We have spoken throughout of behaviorism as though all behaviorists were agreed and uniform in their doctrine. This is not the case, of course. Our brief summary gives the views of Watson, modern behaviorism's founder. But behaviorism is not a one-man school; there are many behaviorists who differ with Watson in one way or another.

form.* Of these, the favored translations are configuration and form; although even they do not in their usual meanings convey the essential and distinct connotation of the word *Gestalt.* It is for this reason that the German word itself is being widely used in English; and it is not improbable that shortly the word will be incorporated into the English psychological vocabulary without attempts at translation. However, if we use the terms form and configuration, we do so with the realization that they signify something more than they ordinarily do. This will become clear in the following explanation.

Gestalt theory asserts that experiences and behavior, to begin with, are organized wholes (or structures) as opposed to mere aggregates, the whole being prior to its parts. Thus it denies that mental processes are composed of elements found in them by analysis. Our perceptions are unified wholes perceived as distinct from their surroundings; they are not just masses of sensations or elements. This is true even of young infants whose perceptions, though meager and gross, are still organized. We see trees, sky, pictures, buildings, and other objects, as such. We hear melodies, not a series of notes. These and other perceptions are what the Gestaltists call unified "figures" against a relatively undifferentiated and relatively unorganized "ground" (background). Therefore, from this standpoint psychology should study and explain the "common sense" experiences which existentialists reject.

This viewpoint denies that behavior is merely a summation of elementary responses to stimulating elements in the situation. Gestalt theory affirms that behavior is a unified, organized whole, tending toward a goal, intended to restore a state of equilibrium, the external or internal stimulating situation having created in the organism a state of tension

* This particular psychological viewpoint gets its German name because it was developed and originally presented by a group of German psychologists in 1912.

which it seeks to resolve. It is the totality and direction of behavior that are primary; the details, or elements, are secondary, being determined by the goal and direction of the total behavior. In other words, the whole is primary to its parts. For example, in learning to write, the child's movements are at first general and crude, but unified. Slowly his movements become more and more defined, limited, and specialized until he reaches a point where he has precise and automatic control over his fingers.

Gestalt psychology maintains that the properties of wholes should be studied as they occur in experience and in behavior. To begin with elements is to start at the wrong end; for elements are the products of logical reflection and analysis. Thus, to break down a configuration for purposes of analysis is to destroy the very situation that is to be studied. Furthermore, it is a basic concept of Gestalt psychology that the whole configuration is different from the sum of its parts; for the organization and interrelationships and reciprocal influences of the parts are just as real and important as the parts themselves. To support this view, Gestalt psychologists point out, as an example, that the expression of a human face is a unified whole; since by changing the general expression, certain *parts* undergo change in character without any actual change having been made in those parts. For instance, by altering the expression of the mouth and its immediate vicinity, the *expression* of the eyes undergoes a change, although the objective character of the eyes themselves has in no way been modified. It is pointed out, further, that personality is not a mere summation of independent traits, for such an inventory of traits does not show the rôle of each in the unified dynamic individual. Also, in any situation an individual's behavior can be understood only through a knowledge of the interplay of forces in relation to the person's needs, background, and goal. Some of these forces are positive (attraction); others are negative (avoidance); each may vary in intensity and significance for dif-

ferent individuals; and the rôle of each force is influenced by the psychological presence and effectiveness of the other forces. Thus, to isolate any of these elements or parts for separate study would be to destroy the integrity of the behavior-situation and to alter the very nature of the segregated elements as well as that of the total situation. Analysis would thus destroy the thing it seeks to examine and explain; for its total character and uniqueness are thereby lost. Or, to put it otherwise, the characteristics of any element are in part dependent upon the configuration, or form, of which it is a member. This being so, the importance of studying wholes rather than elements is apparent.

Gestalt psychologists find verification in the field of sensory perception as well. We continue to see certain "favored forms" in spite of the fact that only rarely does the actual retinal image strictly reproduce those forms. For example, we see objects as rectangular (a desk top) or as circular (a plate) although it is very unusual for the retinal image to be truly one or the other. This can be confirmed by photographing the desk top or the plate from the same position as the eyes. The photographic reproduction will "look" distorted. What, then, is the explanation of this phenomenon? The fact is that no certain explanation is available. But the Gestalt psychologist regards as incorrect the earlier explanation which stated that through innumerable experiences with rectangular and round objects the individual comes automatically to make corrections and "see" objects as he knows they should be. This explanation is invalidated by the fact that young children and other naive observers see the "favored forms" and reproduce objects as rectangular or circular, although these objects do not appear so in perspective. Witness the way a child draws a chair, with square back and square seat attached. In place of this "experience" theory, the Gestalt theory offers an hypothesis of its own: namely, that the very structure of the object and the nature of brain activity are such as to dispose us to see these forms as such;

and precision. Finally, Gestalt psychology is functional in character; for it is concerned not only with methods of investigation and theoretical interpretation, but with aims, striving, and meaning of behavior. Unlike the static view of structuralism, Gestalt regards behavior as a dynamic process of adjustment.

Purposive (Hormic) Psychology. According to William McDougall, the outstanding advocate of this viewpoint, striving and seeking are the primary forces in behavior. Purposive psychology asserts, therefore, that the organism's active striving towards a goal is a fundamental concern and subject of study for psychology. Purposive activity, according to McDougall, becomes known to the individual as mental activity. The individual perceives the situation, anticipates the effects to be produced by his activity, strives toward the goal, and experiences satisfaction when the goal is reached. According to purposive psychology behavior is initiated by the presence in the organism (man and infrahuman animals) of certain aims or ends or goals toward which it strives.

The next questions, then, are whence do these purposes come, and what are they? McDougall answers that instincts are the springs of action. Conduct rests ultimately upon these primary impulses which, so far as we know, are ultimate and must be accepted because they are self-evident, just as in geometry axioms, being self-evident, are accepted.

McDougall explains, further, that the instinct has three characteristics: (1) the receptive, being a predisposition to perceive certain stimuli that arouse activity; (2) the executive, being a predisposition to make certain movements or to produce certain changes in the situation; and (3) the emotion, being the core of the whole instinct and operating throughout. The emotional aspect signifies that an instinct is not only a way of acting but involves the organism vitally and is attended by profound bodily changes. Naturally, each instinct has its accompanying emotion, from this standpoint.

McDougall lists a number of major instincts, among them

being such complex and varied forms of behavior as the instincts to escape from danger, to protect the young, to mate, to assert oneself, to construct, and others. He enumerates, also, some "minor instincts," including sneezing, elimination, and other such relatively simple functions. But these minor instincts play a small rôle in social life and adjustment, whereas the major instincts are of great importance and provide the basic motives for an explanation of social living and social phenomena.

Although instinctive behavior forms are inherited by the individual as separate tendencies and are the original springs of his activity, they do, in the course of time and experience, become combined into complex attitudes, called *sentiments*. That is to say, more than one instinct can get attached to or associated with an object, a person, or an institution. It is this kind of combination that constitutes the sentiments in older children and adults. For example, one's family becomes associated with a number of instincts, resulting in the complex sentiment known as family loyalty or devotion. The family is threatened physically or economically, arousing fear; the reputation of the family is attacked, arousing anger; members of the family enter into competition with others, arousing self-assertion; the family is a refuge and a place of security, arousing love. The complex sentiment of loyalty and devotion becomes a driving force in the individual's behavior. Thus, a sentiment is an organized and relatively enduring system of dispositions concerning a particular object or class of objects. The sentiment has functional unity. McDougall maintains, at the same time, that behavior is not the result of purely rational considerations but derives from one's sentiments such as one's hates, loves, rivalries, zeals, interests, and enthusiasms, all of these having developed from the original instincts.

In summary, then, the position of the purposivist is that behavior is goal-seeking; goal-seeking depends upon motives; and the primary motives are derived from instincts. The

instinct is not an explicitly and rigidly developed activity; the details of behavior are not fixed; but the instinct is a tendency to achieve a certain purpose. For instance, the instinct of combat is not a rigidly defined fighting activity; but it is a tendency to employ energy and anger in resisting interference. And, finally, instincts are modifiable through experience in respect to the situations arousing them and in their modes of expression.

Dynamic Psychology. Dynamic psychology is commonly associated with the name of Woodworth who, however, disclaims any intention to establish a "school." The fundamental concept of this viewpoint is that psychology is the study of cause and effect of behavior. And emphasis is put upon internal drives and motives. Dynamic psychology sets out to trace observable sequences of events and to determine causes and effects.

According to Woodworth, an external stimulus is only a part of the cause of a response. Other contributing factors are the structure of the behaving organism, its store of energy, its general condition, and its activity at the time of the stimulation. In the second place, no stimulus-response activity may be considered as occurring in isolation; for the behaving individual is subject at any one time to a multitude of stimuli. And third, Woodworth holds that changes and flexibility of behavior are determined in the central nervous system.

Dynamic psychology, according to Woodworth, faces two questions: first, the problem of *how* something is done; and second, the problem of *why* something is done. The first is the problem of the mechanism (or structure) involved, while the second is the problem of the drive (power) or impulse involved. An understanding of the mechanism requires the study of the nervous system, muscles, glands, and bodily structure. The drive may be clearly internal, such as hunger, thirst, elimination, sex; or it may be external, such as a reward, or a job to be done; or it may involve curiosity, in-

terest, self-assertion, and the like, regarding whose origin (internal or external) psychologists differ. In effect, then, drives may be simple or complex needs, cravings, or purposes; long- or short-range activities. It is not necessary, according to this view, to go beyond the organism itself to find the cause of its behavior. What the organism does in a given situation is the response of a living individual which by its very structure, organization, and experience possesses certain impulses that initiate various forms of behavior. It is not necessary to assume the existence of any forces outside the individual himself to account for his behavior. The individual behaves as he does because he is a mechanism that is built to behave that way, and because he is a mechanism that can acquire certain other ways of behaving.

This doctrine is similar to McDougall's purposivism insofar as it ascribes goals and strivings to the organism. It differs from purposivism in that it does not ascribe a metaphysical or external driving power to the organism. Instead it attempts to account for all behavior by the characteristics of the organism's entire bodily mechanism.

There is still another essential difference between McDougall's purposive and Woodworth's dynamic psychology. Woodworth's list of innate human responses includes native capacities on the intellectual side of human nature. These, he asserts, are also drives to action. By native capacities, Woodworth means what is generally meant by intelligence, aptitudes, and special abilities. Whereas McDougall says that such capacities are distinctly secondary and, indeed, impotent without the driving force of the instincts, Woodworth maintains that the capacities of the intellect have the same driving power as the others. The latter believes that the intellectual drive and others reinforce and supplement one another.

Dynamic psychology, therefore, is not to be regarded as contrary to purposive. The two agree in respect to the fundamental concept of striving and motivation; but they

disagree as regards the source of the motives and as to the rôle of intellectual drives.

Organismic Psychology. This viewpoint takes the same position as the Gestalt, the functional, the dynamic, and the purposive points of view in respect to their emphasis upon the unity and wholeness of an organism's behavior. Organismic psychology does, on the other hand, reject the instinct doctrine as developed by McDougall, Woodworth, and others. In this rejection, it takes the same position as behaviorism.

According to the organismic theory, innate organic states and responses and learned behavior interpenetrate to form the basis of activity; and behavior itself is caused by environmental stimuli and initiating physiological states. But behavior is always a totality, involving the organism as a whole. Behavior is not a matter of individual sensory and motor segments responding independently and exclusively. That this is so has been demonstrated in experiments with and observations upon animals low in the scale of life, as well as with higher animals and man.[7] In a given situation, the organism as a whole is concerned with the task at hand, its energy and appropriate behavior mechanisms being directed to the task. Furthermore, the way the organism responds, the particular responses it makes, and the direction of its activity will depend upon the organization of the environment or situation which initiates the behavior. In brief, then, the organismic doctrine, which is a modified behaviorism, stresses the wholeness of an organism's activity as well as the unified and organized character of the situation in which behavior takes place.[8]

Psychoanalysis. It is extremely difficult to give an adequate presentation of this widely publicized system of dy-

[7] See Jennings, H. S., *Behavior of the Lower Organisms*, New York, Columbia University Press, 1915; Child, C. M., *Physiological Foundations of Behavior*, New York, Holt, 1924; Gilhousen, H. C., *The Use of Vision and of the Antennae in the Learning of Crayfish*, University of California Publications in Physiology, 1929.

[8] Under "Learning," the student should again refer to the sections on the goal in learning and organization as a factor in learning.

namic psychology in a few pages. We shall, therefore, attempt only the barest outline in an effort to acquaint the student with the "pillars" of the system. The point of view presented is that of Freud, the founder of psychoanalysis. This will be followed by very brief statements of the theories of Freud's two outstanding pupils, Jung and Adler, who broke away from their teacher's theoretical conceptions to set up their own.

Psychoanalysis is a system of dynamic psychology which attributes behavior impulses to factors in the unconscious. For the investigation of the unconscious, psychoanalysts have developed techniques which are utilized in the treatment of nervous and mental disorders and of personality flaws. In fact, psychoanalysis had its origin in attempts by Freud and others to cure neuroses.* The theory of psychoanalysis has been employed also in the interpretation of a variety of cultural phenomena, such as religious ceremonials, social taboos, and group customs, because these are held by psychoanalysts to be related to the neuroses.

According to psychoanalytic theory, the psychic life of the human being has two main parts: namely, the *conscious* and the *unconscious*. The conscious part consists of only a relatively small and relatively unimportant segment of one's psychic life and experiences. It is the mental content of which the individual is aware at any given time. But beneath the conscious is the vast and powerful unconscious which is said to be the source of hidden drives and psychic energies that constitute the real motivating power of human activity. The psychic processes going on in the unconscious, unknown to the individual, have a powerful influence upon his behavior and thinking. The content of the unconscious is derived from two sources: namely, original or innate drives which are not permitted to come into the conscious, and materials that have been *repressed* into the unconscious from

* A neurosis is a less severe and less enduring disorder of the nervous system for which no actual lesion is found.

the conscious. Between these two—the conscious and the unconscious—lies the *preconscious* which merges gradually into both. It harbors the materials of ordinary memory. The preconscious is thus more closely related to the conscious than it is to the unconscious. For, unlike the latter, it does not consist of actually repressed psychic desires and materials. On the contrary, the contents of the preconscious can be brought into the conscious by the ordinary processes of association without emotional resistance, without conflict, and undisguised. This is not true of the materials of the unconscious when they come or are brought to the level of the conscious.

These three levels—the conscious, the preconscious, and the unconscious—are Freud's earlier formulation of the forces and springs of activity. But Freud has been ready to modify and supplement his system as new problems have been encountered and new materials secured. Consequently, his more recent formulation includes three new entities whose relationships to the earlier three have not been altogether clearly or finally determined. The relationships have, however, been suggested. The three newer members of the system are the *Id*, the *Ego*, and the *Super-Ego*.

The Id (the Latin term meaning the "it") corresponds to the unconscious. In fact, some psychoanalysts think it supplants the unconscious, while others believe it supplements it. At any rate, the Id is really personalized and given a character. It does things; it behaves. It is the most deeply rooted, the most primitive, and most powerful component of personality, residing in the unconscious. It is made up principally of the instinctive sexual drive, about which more will be said later. Yet it includes, also, those tendencies which have been repressed. And it includes, as well, the tendencies, or psychic energies, that an individual inherits from the race. The Id is primitive in nature, unmoral, lacking perception and the power of critical evaluation. Instead,

it seeks and insists upon the pleasures and satisfactions of the immediate and direct fulfillment of the primitive urges.

The Ego (the "I") develops out of the Id. It partakes in part of the unconscious and in part of the conscious. The Ego, weak in infancy, grows gradually through the individual's contacts with the external world. It is, so to speak, the mediating agent between one's self (presumably the "instinctive" or primitive self) and the world outside. The Ego in the normal adult perceives reality and is rational. Thus, whereas the Id craves pleasures and satisfactions blindly, the Ego perceives the external world and regulates the activities of the Id with reference to that world. The Ego, therefore, is the force or entity that decides which impulses and experiences shall be repressed back into the Id (or unconscious) and which satisfactions shall be granted. It is in this way that the Ego is associated with both the conscious and the unconscious.

The Super-Ego is a newer conception of Freud's, not found in his earlier formulation of the unconscious, preconscious, and conscious. This newer entity, or force, corresponds to what is generally known as "conscience." It is constituted of morals, behavior concepts, and taboos inherited by the individual from the race, as well as of the ideals, prohibitions, and behaviors acquired by the individual from his parents during infancy and childhood. There are thus in this Super-Ego elements of inheritance and elements of learning. But the former—the inherited notions—are far more significant and powerful than the latter. The Super-Ego, therefore, belongs more to and is more closely associated with the unconscious than it is with the conscious. But this "conscience" also watches over and fights with the Ego, over which it has considerable power. In short, the Super-Ego is a person's unconscious morality which may be and often is at variance with one's conscious principles and behaviors.

Freud's psychic structure is complex and often confusing and elusive. Yet there is always the basic concept of the self

in conflict with unconscious desires. Throughout his theory, Freud stresses the presence of striving and repressions, resistance, circumvention of resistance, and indirect satisfaction of urges. The presence of unconscious desires and the necessity of repressions are the two crucial points upon which Freudian theory rests. No one escapes conflicts between desires and repressions. In everyone, some impulses are thwarted; consequently, in everyone there are evidences of warfare of the conscious and the unconscious, with resulting tensions.

According to Freud, the sexual drive is the all-pervasive one; it plays the major rôle in human conduct. It is, however, not the sole motive; for Freud recognizes impulses of self-preservation and, paradoxically, the "death instinct" (as manifested in sadism and suicidal tendencies). The term "sex" is used in a very general sense; it refers to more than the specifically sexual interests of the adult. It includes the whole "love life" or "pleasure life," ranging from such relatively simple activities as bathing and smoking to complex activities such as artistic creation and religious ceremonial. The sex impulse is present throughout life, in varied forms, from earliest infancy through senescence.

A second crucial concept of Freud's theory is that of repression. From the start of life, society imposes powerful taboos upon its members. All manifestations of sex are forced out of sight and into the unconscious as disgraceful and reprehensible. But though repressed into the unconscious and frustrated, the desires live on, striving to find expression by circumventing the Ego. Repressions, however, are not simply products of the adolescent or adult period. It should be recalled that psychoanalysis began as an attempt to understand and cure neuroses. In that attempt, analysts found that neurotic symptoms are indirect expressions of repressed desires and repressed memories, resulting in malformation of conduct. Furthermore, in tracing out the repression, they were led back into childhood and infancy, thus

arriving at their concept of infantile sexuality. The object of repression, therefore, is either a forgotten, unfulfilled impulse or a forgotten item in memory. But since the event has been excluded from consciousness and kept down by force, it survives charged with emotion, seeking indirect and disguised expression. One of the ways the repressed experiences find an outlet is through neuroses, as already stated.

But there are also other ways of finding an outlet, according to the theory. There are numerous channels that society approves, such as myths, religious ceremonial, and even social institutions, all of which are symbolic and disguised expressions for the gratification of repressed impulses. The urge for achievement and striving for power and wealth are other forms of expression, since they attract the favorable attention of the other sex.

The Ego also provides a type of outlet or compromise behavior for the content of the Id through what are called *dynamisms*. These are specific masked or indirect ways of expressing repressed tendencies. One such is *rationalization* whereby an individual substitutes a reason acceptable to the Ego for behavior, but one which is not the real reason. Another is *sublimation* whereby a socially approved outlet is provided for a desire which is not allowed direct expression. Still another is *phantasy*, whereby repressed wishes are indulged in disguised form, as in day-dreaming. There are eighteen such dynamisms, all serving to provide outlets and releases of tensions which are not permitted direct expression.

Dreams, however, are said to be one of the most significant and revealing channels for the expression of repressed desires and memories. Every dream is, accordingly, a disguised manifestation and satisfaction of impulses that are not allowed to come into consciousness during waking life. But even in the dream, the desire does not express itself frankly and fully; for the repressed desire takes on disguises and symbolic forms in order to enable it to get into conscious

ness. It is therefore necessary for the analyst to go beyond the apparent value (manifest content) of the dream to its true significance (latent content). This is the task of the analysis and interpretation of dreams.

Finally, in the Freudian psychoanalytic theory, thought and reason—by some psychologists called the "higher mental processes"—are of secondary importance. They are not dominant forces. Instead they only serve the primal desires.

Not all psychoanalysts, however, agree with the Freudian theoretical interpretation, the two outstanding modifications of his system being those of Jung and Adler, both of whom were pupils of Freud's. Adler broke away and developed what he called "individual psychology." Though he recognized the importance of the sex impulse and the frequency of sex maladjustments in neuroses, he believed, nevertheless, that there was a more fundamental drive. He believed that the dominant drive in life is *self-assertion*. According to him, if this drive is frustrated either by environmental forces or by the individual's own inadequacies it becomes the source of a feeling of inferiority which, if strong enough, is the fundamental fact of neuroses. The self-assertive drive is the cause of achievement of all kinds, while, under unfavorable circumstances, it can be the source of misconduct and maladjustment. This theory, though simpler than Freud's, has been greatly elaborated. It attaches just as much significance to early childhood, during which the individual's pattern of life is said to develop and get adopted. It is from Adler that psychology has the concept of inferiority "complexes."[10] He has provided a coherent theory of personal relationships, particularly within the family, accounting for the play of forces and of individuals upon one another. His views have commended themselves to many child psychologists and educators because they are much easier to grasp, seem to contain

[10] *Popular* usage has added the "superiority complex," but Adler himself held that acts expressing superiority are manifestations to compensate for an inferiority complex.

more immediate relevancy to problems of behavior encountered among children, and therefore are much easier to apply. It is safe to say that in school and out Adler's concepts have had more influence upon the interpretation and treatment of children's behavior problems than the concepts of any other single person.

Jung's doctrine is called "analytic psychology." He too denies that the fundamental drive is the sexual one. Instead he holds that there is a *general life urge*, a vital energy which motivates activity, achievement, and reproduction. Thus it seems that Jung's doctrine attempts to include both Freud's and Adler's within a universal will to live, the vital energy at times expressing itself in self-assertion and at other times in sexual activity.

Jung differs from Freud and Adler also in denying fundamental and primary significance to the years of early childhood. He grants that in childhood years there are to be found "predisposing causes." But he emphasizes the "exciting causes" which operate at the time the neurosis or maladjustment manifests itself. The exciting causes are the situations which demand of the individual new adjustments, new forms of behavior, but which he fails to make. Instead, he lapses into earlier, childish, and inappropriate behavior. Jung's method, therefore, consists first in trying to discover the person's immediate problem and the inadequacies of his attempted solution and adjustment; and, second, in attempting to provide new appropriate modes of behavior and in creating a new synthesis of behavior.

Many psychologists disagree with one or more of the three foregoing men and their doctrines. But regardless of how one receives the doctrines of these men, there is no doubt that psychologists find ample evidence of dynamisms and wish-fulfillment in the lives of children, adolescents, and adults. Also, there is no doubt among child psychologists concerning the importance of the years of childhood in the formation of personality and general behavior patterns.

Further, many psychologists recognize the contribution these three men have made in emphasizing the emotional and striving aspects of the human personality, by contrast with an earlier emphasis upon the intellectual. Finally, most will grant that Freud has made a valuable contribution in making the sex impulse a matter of scientific study, to be removed from the realm of superstition and taboo. All of these contributions many will acknowledge without accepting what to them may appear to be unnecessarily elaborate and at times mystical interpretations.

Summary. In this chapter we have presented brief statements of psychological points of view, or "systems" without an effort at critical evaluation. Our main purpose has been to provide the students with such statements of doctrines as *will enable them to identify and at least apprehend these* when they come upon them in either technical psychological readings or in the non-technical fields which make use of or reference to psychological principles.

It will be apparent from this survey that formal psychology started out as the laboratory analysis of mental states, having no reference to life activities. It was to be a "pure" and descriptive science, unconcerned with human or social values. But it was not long before some psychologists insisted that the real function and problems of the science were to provide principles that would explain the causation of behavior and permit its direction and control (functionalism). Psychology thus entered applied fields. Then came insistence upon a purely objective method of study (behaviorism) which would dispense with the use of consciousness and other such subjective aspects that had given psychology its previous claim to independence as a science. While functionalism and behaviorism were developing and gaining adherents, the Gestalt theory came into prominence, claiming not that the subject matter of psychology must be changed, but rather that the methods of investigation and the interpretations must be such as to take into account the situation as an indivisible whole;

for to break down a situation or a personality for purposes of analysis is to destroy the very object that is to be studied and understood. Finally, we saw that with causation and control of behavior in the ascendant as the subject matter of psychology, motivational psychology flourished in the form of the purposive, the dynamic, and the psychoanalytic doctrines. That being the case, it was natural that applied fields should have become prominent both in the minds of the public and of the professional psychologist in an effort to understand human nature, its growth, modification, and control. Consequently, we have seen the growth in importance of psychology as applied to education, child development, adolescent problems, the measurement of abilities and personality, advertising, salesmanship, business and industrial practices, occupational selection, the abnormal, the family, government and law, and still other fields. In short, human psychology is now being defined as the science of human experience and behavior, taking for its domain of study all of man's activities.

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